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AUTHOR	Ziller, T.
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ABSTRACT

One of two individualized courses included in an appliance repair curriculum (see CE 027 767), this course covers minor and major heater-type appliances. The course is comprised of six units: (1) Irons, (2) Roasters, (3) Space Heaters, (4) Water Heaters, (5) Electric Ranges, and (6) Gas Ranges. Each unit begins with a Unit Learning Experience Guide that gives directions for unit completion. The remainder of each unit consists of Learning Activity Packages (LAP) that provide specific information for completion of a learning activity. Each LAP is comprised of the following parts: objective, evaluation procedure, resources, procedure, supplemental sheets, study guide, and a LAP test with answers. The course is preceded by a pretest which is designed to direct the student to units and performance activities. (LRA)

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ED197138

MOUNTAIN PLAINS LEARNING EXPERIENCE GUIDE:

Appliance Repair. Course: Heater-Type Appliances.

CE 027 766

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Experience Guide

COURSE: HEATER-TYPE APPLIANCES

DESCRIPTION:

This course is about minor and major heater-type appliances. Minor heater-type appliances include protable irons, roasters and space heaters. Major heater-type appliances include gas and electric water heaters, and gas and electric ranges. Due to consumer demand, emphasis is upon major appliances because of high repair costs. Troubleshooting and repair experience is provide either on real or simulated problems. Support to this course includes the theory of simple and complex DC circuits.

RATIONALE:

Many of the domestic appliances are heater-type. Consumers need most of their large appliances and some of their smaller high-cost appliances repaired and serviced. The appliance service person will be expected to service and repair these heater-type appliances.

OBJECTIVES:

Given service information, tools, and materials, you will service, diagnose difficulties, disassemble, repair and replace components for heater-type appliances.

PREREQUISITES:

Successfully pass color-blindness test.

Seven units from the course: DC **Circuits** are prerequisite support to certain units in this Course: Heater-Type Appliances. The prerequisite units are identified in the "Prerequisites" section of the particular unit Learning Experience Guide (LEG) for which it supports.

RESOURCES:

A resource list is attached.

Principal Author(s): T. Ziller

GENERAL INSTRUCTIONS:

This course has six units. Each unit has a Unit Learning Experience Guide (LEG) that gives directions for unit completion. Each unit consists of Learning Activity Packages (LAPs) that provide specific information for completion of a learning activity. Pretesting results direct the student to units and performance activities.

The general procedure for this course is as follows:

(1) Read the assigned unit LEG for this course.
(2) Begin and complete the first assigned LAP.
    a. Take and score the LAP test.
    b. Turn in the LAP test answer sheet.
    c. Determine the reason for any missed items on the LAP test.
    d. Proceed to the next assigned LAP in the unit.
    e. Complete all required LAPs for the unit by following Steps (a) through (d).
(3) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(4) Proceed to the next assigned unit in this course.
(5) Follow steps 1 through 4 for all required units for this course.
(6) Proceed to the next assigned course in your "Appliance Serviceman" Program.

You will work independently unless directed to do otherwise. When questions or problems arise, you are expected to discuss them with the instructor. At all times remember to follow correct safety procedures during the performance activity.

UNIT TITLES:

.01 Irons
.02 Roasters
.03 Space Heaters
.04 Water Heaters
.05 Electric Ranges
.06 Gas Ranges

EVALUATION PROCEDURE:

Course evaluation is by pre and post testing using a multiple-choice type of test.

In this course, the course test is used as a pretest to determine which units, if any, the students may be able to validate. The student is considered validated for a particular unit if 4 out of 5 items are correctly answered for each LAP part on the course pretest and that particular unit does not have a performance test requirement.

For those units with performance test requirements, the student must also satisfactorily complete the performance test to validate that unit. Unit performance test validation procedures are given in the "Evaluation Procedure" section of the unit Learning Experience Guide (LEG).

The course test will also be taken by the student as a post test to determine any changes resulting from taking all or part of the course.

FOLLOW-THROUGH:

At this time you may begin with the guide for the first unit.

RESOURCE LIST

Printed Materials

1. Appliance Service Manuals for appliances used in the program.
2. Catalogs, appliance supply (assortment).
3. Home Appliance Servicing. Second Edition, Edwin P. Anderson, Theodore Audel and Company, 1965.
4. Manufacturer's specification sheets.
5. Order forms.
6. Work order forms.

Audio/Visuals

none

Equipment

1. Heater, space electric.
2. Heater, water, electric.
3. Heater, water, gas.
4. Iron, electric.
5. Range, electric.
6. Range, gas.
7. Roaster, electric.
8. Test Equipment: Amprobe (RS-3 Rotary Meter B-A)
    - Meter, volt-ohm
9. Tools:
    - Box, utility
    - Chisels (1/2" and 5/8")
    - Cutters, diagonal
    - Gun, soldering (100-140 watt)
    - Hammer, ball peen (12 oz.)
    - Kit, solderless terminal
    - Knife, electricians
    - Level, aluminum (18")
    - Nut driver set
    - Pliers, channel-lock (10")
    - Plier, long nose
    - Plier, slip joint
    - Plier, vise grip (size 7")
    - Puncher (3/16", 3/8" and 5/32")
    - Screwdriver, blade (set)
    - Screwdriver, Phillips (set)
    - Tape, steel measuring (12 ft.)
    - Wrench, adjustable
    - Wrench, combination (set)
    - Wrench, hex and spline (kit)

COURSE POST TEST ANSWER KEY

Occupational Area:
File Code: 76.01.00.00.A2-2
Name:

ANSWERS

UNIT 01 LAP 01	1.	C	LAP 05	21.	C	LAP 04	41.	B
	2.	A		22.	C		42.	D
	3.	D		23.	B		43.	B
	4.	C		24.	D		44.	C
	5.	D		25.	C		45.	B
LAP 02	6.	A	UNIT 02 LAP 01	26.	D	UNIT 03 LAP 01	46.	C
	7.	D		27.	B		47.	A
	8.	C		28.	C		48.	D
	9.	D		29.	B		49.	A
	10.	B		30.	D		50.	A
LAP 03	11.	B	LAP 02	31.	D	LAP 02	51.	C
	12.	C		32.	B		52.	B
	13.	B		33.	A		53.	B
	14.	A		34.	B		54.	D
	15.	A		35.	C		55.	C
LAP 04	16.	C	LAP 03	36.	A	LAP 03	56.	B
	17.	D		37.	C		57.	C
	18.	B		38.	C		58.	C
	19.	A		39.	D		59.	A
	20.	A		40.	A		60.	A

COURSE POST TEST ANSWER KEY

Occupational Area: ____________
File Code: 76.01.00.00.A2-2
Name: ____________

ANSWERS

UNIT 03 LAP 04
61. A
62. D
63. A
64. B
65. B

UNIT 04 LAP 01
66. A
67. C
68. B
69. C
70. D

LAP 02
71. B
72. C
73. D
74. C
75. D

LAP 03
76. D
77. B
78. A
79. D
80. B

LAP 04
81. A
82. B
83. C
84. B
85. C

LAP 05
86. B
87. C
88. D
89. C
90. D

LAP 06
91. A
92. B
93. D
94. B
95. D

LAP 07
96. C
97. D
98. A
99. C
100. A

LAP 08
101. B
102. A
103. A
104. D
105. A

UNIT 05 LAP 01
106. A
107. D
108. B
109. C
110. D

LAP 02
111. B
112. C
113. A
114. D
115. D

LAP 03
116. D
117. C
118. B
119. B
120. C

COURSE POST TEST ANSWER KEY

Occupational Area: ____________________
File Code: 76.01.00.00.A2-2
Name: ____________________

ANSWERS

UNIT 05 LAP 04	121. A	LAP 04	141. D	161.
	122. B		142. C	162.
	123. A		143. D	163.
	124. D		144. A	164.
	125. B		145. D	165.
UNIT 06 LAP 01	126. A		146.	166.
	127. A		147.	167.
	128. D		148.	168.
	129. C		149.	169.
	130. D		150.	170.
LAP 02	131. B		151.	171.
	132. B		152.	172.
	133. A		153.	173.
	134. C		154.	174.
	135. D		155.	175.
LAP 03	136 D		156.	176.
	137. A		157.	177.
	138. B		158.	178.
	139. A		159.	179.
	140. A		160.	180.

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Mountain-Plains Education &
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Program, Inc.

Glasgow AFB, Montana 59231

Learning Experience Guide

UNIT: SPACE HEATERS

RATIONALE:

Every appliance serviceman is expected to service and repair various types of electric space heaters. To be an effective serviceman, he must understand how a particular appliance works. It takes a great deal of skill and understanding to be a proficient serviceman.

PREREQUISITES:

76.01.02 Unit: Roasters

OBJECTIVES:

Operate; disassemble; diagnose malfunctions; repair, replace or service component parts; and reassemble a space heater according to manuafacturer's specifications using appropriate service manuals, equipment and tools, and following safe practices.

Identify characteristics of operation; components; and diagnostic repair and service procedures for electric space heaters.

RESOURCES:

Printed Materials

Appliance Service Manuals for appliances used in the program.
Catalogs, appliance supply (assortment).
Home Appliance Servicing. Edwin P. Anderson, 2nd Edition, Theodore Audel and Company, Indianapolis, Indiana, 1965.
Order forms.
Work order forms.
Manuafcturer's specification sheets.

Equipment

Test Equipment: Amprobe (RS-3 Rotary Meter B-A).
Meter, volt-ohm.

Principal Author(s): T. Ziller

Tools:

Box, utility.
Chisels, (½" and 5/8").
Cutters, diagonal.
Gun, soldering (100-140 watt).
Hammer, ball pein (12 oz.).
Kit, solderless terminal.
Knife, electricians.
Level, aluminum 18".
Nut driver set.
Pliers, channel-lock (10").
Plier, long nose.
Plier, slip joint.
Plier, vise grip (size 7").
Puncher (3/16", 3/8" & 5/32").
Screwdriver, blade (set).
Screwdriver, Phillips (set).
Tape, steel measuring (12 ft.).
Wrench, adjustable.
Wrench, combination set.
Wrench, hex & spline (kit).

GENERAL INSTRUCTIONS:

This unit consists of four Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) In this Unit, there are some LAPs that have tests combined with other LAP tests. These combined tests are taken after completing the last LAP covered by the test.
(9) Take the unit test as described in the Unit LEG "Evaluation Procedures".
(10) Proceed to the next assigned unit.

PEFORMANCE ACTIVITIES:

.01 Operation of an Electric Space Heater.
.02 Disassembly of an Electric Space Heater.
.03 Diagnosis of Malfunctions in an Electric Space Heater.
.04 Repair, Service and Reassembly of an Electric Space Heater.

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

After reading this unit guide, obtain the LAP for the first assigned performance activity.

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UNIT PRETEST: SPACE HEATERS

76.01.03.01

1. Some forced-draft space heaters incorporate what, that permits two different heat-setting selections?

   a. two-heat switch.
   b. single pole switch.
   c. three way switch.
   d. four way switch.

2. The amount of heat from a space heater can be varied by:

   a. adjusting the contact points on the thermostat.
   b. connecting heating elements in series or parallel.
   c. adjusting or regulating the current draw.
   d. combining the potential difference of the elements.

3. The amount of heat from an electric space heater can be varied, but each unit must be designed to operate at what voltage?

   a. full circuit voltage.
   b. minimum voltage.
   c. constant voltage.
   d. fixed voltage.

4. What is the final process that completes the conventional heating cycle on the immersion-type space heater?

   a. the water is diluted by the heat process.
   b. water contacts the heating elements, it is converted into steam.
   c. the element draws less current.
   d. the water is heated by radiation.

5. With a radiant and fan-forced space heater plugged into a proper power source and the control knob turned clockwise closing the contacts, what elements are energized?

   a. the temperature control and fan motor only.
   b. the heater element only.
   c. the heater element and fan motor only.
   d. heater element, fan motor, temperature control, and tip-over switch.

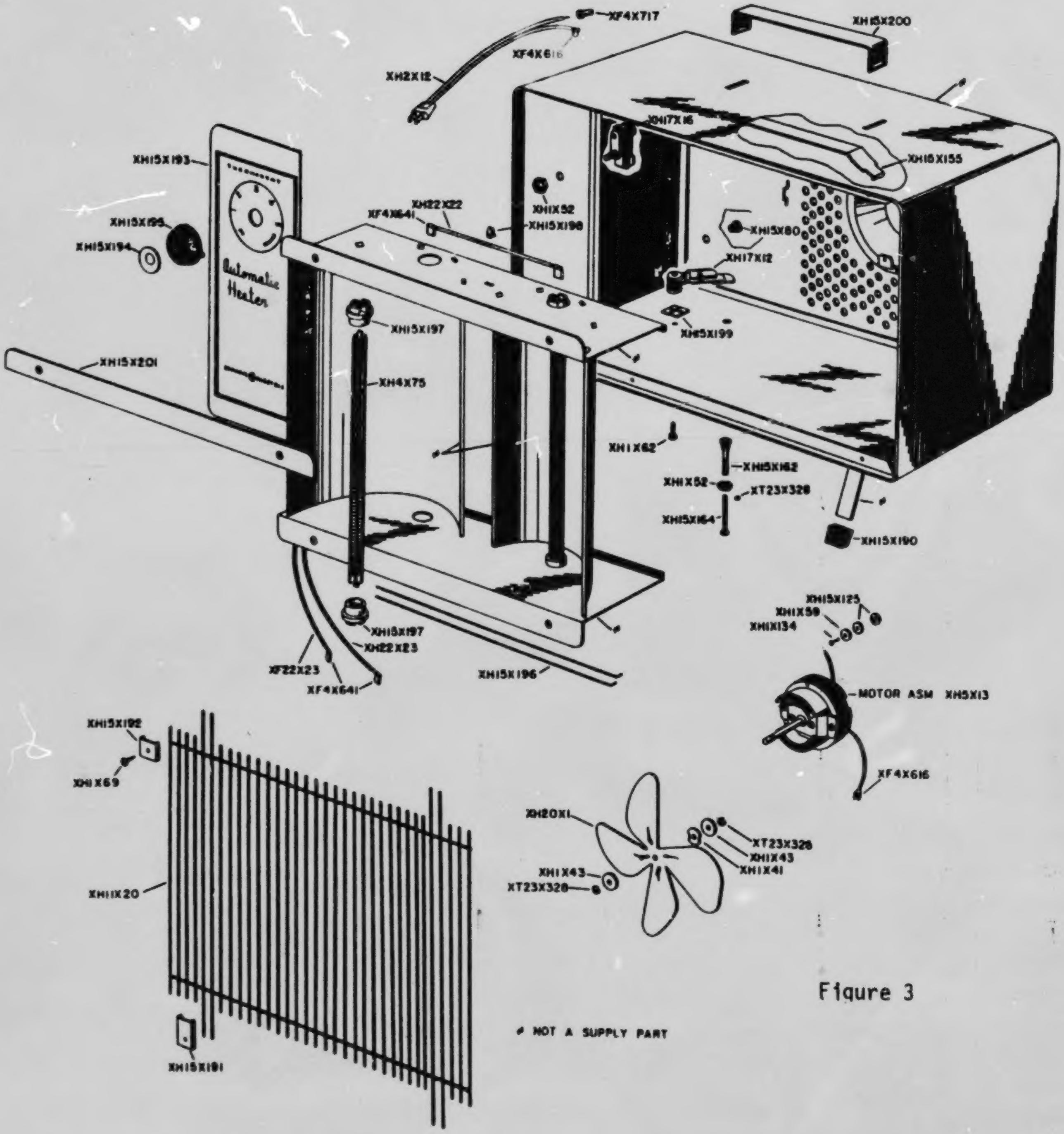

Figure 3

# NOT A SUPPLY PART

76.01.03.02

6. Which part number in Fig. 3 shows the location of the cordset on an electric space heater?

   a. XF22X23
   b. XF4X616
   c. XH2X12
   d. XF4X641

7. Which part number in Fig. 3 (electric space heater) indicates the location of the motor assembly?

   a. XF4X616
   b. XH5X13
   c. XH20X1
   d. XH17X16

8. Which part number in Fig. 3 (electric space heater) indicates the location of switch mounting spacer?

   a. XH15X198
   b. XH15X164
   c. XH15X199
   d. XH1X52

9. Which part number in Fig. 3 (electric space heater) indicates the location of the strain relief?

   a. XF4X717
   b. XH15X80
   c. XH15X192
   d. XH15X191

10. Which part number in Fig. 3 (electric space heater) indicates the location of the guide plunger?

   a. XH15X196
   b. XH15X164
   c. XH1X62
   d. XH15X162

76.01.03.03

11. On an electric space heater when equipped with a tip-over switch that continues to heat when the heater is tipped over, what should be checked?

   a. the thermostat.
   b. the source of power.
   c. position of switch with relation to plunger.
   d. the fields of the motor.

76.01.03.03 (continued)

12. If an electric space heater is operating noisily, check for which of the following?
    - a. high resistance draw.
    - b. high voltage drop.
    - c. binding or striking.
    - d. line source is faulty.

13. If the switch contacts on an electric space heater are touching the plunger, with the plunger all the way out, what procedure must be followed?
    - a. use a high voltage to oil the points.
    - b. use a rasp and repair the points.
    - c. replace the points on the switch.
    - d. switch must be replaced.

14. If heat setting (watts) cannot be changed on an electric space heater, check:
    - a. thermopile.
    - b. thermocouple.
    - c. switch.
    - d. thermodynamic.

15. Check defective line cords on an electric space heater with what instrument?
    - a. ohmmeter.
    - b. voltmeter.
    - c. pyrometer.
    - d. ammeter.

76.01.03.04

16. Which of the following steps should be done first when disassembling an electric space heater?
    - a. check resistance of elements.
    - b. check voltage drop.
    - c. check current draw.
    - d. unplug heater from power source.

17. Element replacement in immersion-type space heaters requires the manufacturer's replacement for which of the following reasons?
    - a. elements are of fixed current draw.
    - b. element assembled within an enclosure.
    - c. elements are of variable voltage.
    - d. elements have fixed voltage.

76.01.03.04 (continued)

18. In order to obtain the correct heating valve in a new heating element on a bowl-type electric space heater, check:

    a. wattage rating of the element of the heater nameplate.
    b. resistance rating of the thermostat on the nameplate.
    c. amperage rating of the element on the nameplate.
    d. voltage rating of the element on the nameplate.

19. After determining the heating element is defective in a convection-type electric space heater, first:

    a. disconnect the thermostat.
    b. replace the heating element.
    c. disconnect the wires from their terminals.
    d. replace the electric cord.

20. When removing the fan or installing a new blade in the fan-type electric space heaters, the track and pitch of the blade should be checked by:

    a. "eyeing up" the blades as they turn around on the motor.
    b. placing the fan blade face down on a smooth surface and measuring each blade individually to its highest point.
    c. adjusting pitch at 45^0 degrees.
    d. adjusting track to follow within one inch of the protective shield around the blades.

UNIT TEST ANSWER SHEET

PRETEST

Occupational Area:

File Code: 76.01.03.00.A2-2

Name:

ANSWERS

76.01.03.01	1.	A	21.		41.	
	2.	B	22.		42.	
	3.	A	23.		43.	
	4.	B	24.		44.	
	5.	D	25.		45.	
6.01.03.02	6.	C	26.		46.	
	7.	B	27.		47.	
	8.	C	28.		48.	
	9.	B	29.		49.	
	10.	D	30.		50.	
76.01.03.03	11.	C	31.		51.	
	12.	C	32.		52.	
	13.	D	33.		53.	
	14.	C	34.		54.	
	15.	A	35.		55.	
76.01.03.04	16.	D	36.		56.	
	17.	B	37.		57.	
	18.	A	38.		58.	
	19.	C	39.		59.	
	20.	B	40.		60.	

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Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Operation of an Electric Space Heater

OBJECTIVES:

Describe the operation of an electric space heater.

Draw a schematic diagram of the electrical circuits for the space heater.

EVALUATION PROCEDURE:

Student is to write a description about the operation of an electric space heater that is consistent with the attached checklist.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Operation of an Electric Space Heater.
Home Appliance Servicing, Anderson.

Electric Space Heater.

PROCEDURE:

1. Read and study carefully the information found on pages 150-157 Home Appliance Servicing.
2. Operate the appliance and observe the characteristics of the appliance while taking the steps listed on the attached operational checklist.
3. Describe the operation of an electric space heater and draw a simple schematic of the circuits.
4. Complete the multiple-choice test items for this LAP.

Principal Author(s): T. Ziller

5. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

CHECKLIST: OPERATION OF AN ELECTRIC HEATER

_____ 1. Turn space heater thermostat to "off" position.

_____ 2. Plug space heater into 115V 60Hz 15A fused outlet.

_____ 3. Turn the thermostat control to the first heat setting.

NOTE: The elements turn red as the current travels through the series connected circuit. The heart of the thermostat is a bimetallic strip which also functions as the on/off switch.

_____ 4. Adjust thermostat to all the heat settings.

NOTE: The operation of the space heater is the same as the electric iron and roaster.

_____ 5. Tip space heater forward and backward.

NOTE: A tip-over switch opens the series circuit which acts as a safety feature.

_____ 6. Turn thermostat "off", disconnect from power source and let cool.

Student: ______________________ File Code: 76.01.03.01.A2-2

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LAP TEST: OPERATION OF AN ELECTRIC SPACE HEATER

1. Space heaters work on what principle?

   a. mechanical resistance.
   b. mechanical energy.
   c. electrical resistance.
   d. electrical potential.

2. The heated wires in a convection-type space heater heats the air by:

   a. radiation and convection.
   b. conduction and radiation.
   c. conduction and convection
   d. conduction.

3. The resistance wires in a bowl-type space heater heats the air by:

   a. convection and radiation.
   b. conduction.
   c. convection.
   d. radiation.

4. Convection-type space heater consists of what, through which air can circulate over the heating element surface?

   a. perforated sheet metal cases.
   b. perforated plastic cases.
   c. perforated glass cases.
   d. perforated formica cases.

5. With the blower-forced space heater plugged into the proper outlet and the selector knob turned to cool, what occurs?

   a. the heater will not operate.
   b. the heater circuit is energized.
   c. the motor and heater circuits are energized.
   d. the motor circuit is energized.

6. When the blower-forced electric space heater selector knob is turned to medium and the thermostat is turned to a high setting, what occurs?

   a. both the heating element and the motor circuits are energized.
   b. the heater element is energized.
   c. the blower element is energized.
   d. the thermostat circuit is energized.

7. In most types of forced-draft space heaters a cool air circulation is provided by means of:

   a. a combination of conduction and radiation.
   b. conduction.
   c. radiation.
   d. a fan to operate without actuating the heating elements.

8. The amount of heat from an electric space heater can be varied, but each unit must be designed to operate at what voltage?

   a. full circuit voltage.
   b. minimum voltage.
   c. constant voltage.
   d. fixed voltage.

9. When an electric current is passed through the resistance wire on the immersion-type space heater, what occurs?

   a. causes the water to boil.
   b. electric shock may be produced.
   c. the potential difference in voltage causes heat.
   d. convection causes the water to boil.

10. What is the final process that completes the conventional heating cycle on the immersion-type space heater?

    a. the water is diluted by the heat process.
    b. water contacts the heating elements, it is converted into steam.
    c. the element draws less current.
    d. the water is heated by radiation.

LAP TEST ANSWER KEY: OPERATION OF AN ELECTRIC SPACE HEATER

1. C
2. A
3. D
4. A
5. D
6. A
7. D
8. A
9. A
10. B

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Learning Activity Package

Student: ______________________
Date: ______________________

PERFORMANCE ACTIVITY: Disassembly of an Electric Space Heater

OBJECTIVES:

Disassemble and identify the parts of an electric space heater.

EVALUATION PROCEDURE:

Instructor will examine the disassembled appliance for correct disassembly and parts identification in accordance with the attached checklist.

Correctly answer at least 80% of the items on a multiple-choice test.

RESOURCES:

Checklist: Disassembly of an Electric Space Heater.
Service Manuals for the appliance.

Tools and electric space heater.

PROCEDURE:

1. Follow the steps on the attached checklist: Disassembly of an Electric Space Heater.
2. Complete the multiple-choice test items for this LAP.
3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out shy you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): T. Ziller

CHECKLIST: DISASSEMBLY OF AN ELECTRIC SPACE HEATER

_____ 1. Unplug the heater from power source.

_____ 2. Remove guard wire and/or bottom panel.

_____ 3. Disconnect and remove power cord.

_____ 4. Remove heater elements.

_____ 5. Disconnect and remove thermostat control.

_____ 6. Disconnect and remove motor and fan assembly. (Forced draft heaters only.)

_____ 7. Label and identify each component part of an electric space heater.

_____ 8. Have the instructor check the identification.

Student: ______________________ File Code: 76.01.03.02.A2-2

Date: ______________________ Date Published: 7/28/75

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LAP TEST: DISASSEMBLY OF AN ELECTRIC SPACE HEATER

1. Which part number in Fig. 3 shows the location of the tip-over switch on an electric space heater?

   a. XH15X194
   b. XH17X16
   c. XH17X12
   d. XH15X195

2. Which part number in Fig. 3 shows the location of the cordset on an electric space heater?

   a. XF22X23
   b. XF4X616
   c. XH2X12
   d. XF4X641

3. Which part number in Fig. 3 of an electric space heater indicates the location of the unit lead terminal?

   a. XH22X22
   b. XF4X641
   c. XH22X23
   d. XH15X196

4. Which part number in Fig. 3 of an electric space heater indicates the location of the motor mount bushing?

   a. XH1X59
   b. XH15X125
   c. XH1X134
   d. XF4X616

5. Which part number in Fig. 3 (electric space heater) indicates the location of switch mounting spacer?

   a. XH15X193
   b. XH15X164
   c. XH15X199
   d. XH1X52

6. Which part number in Fig. 3 (electric space heater) indicates the location of the heating unit cap?

   a. XF4X641
   b. XH15X201
   c. XH15X196
   d. XH15X197

7. Which part number in Fig. 3 (electric space heater) indicates the location of the thermostat hex nut?

   a. XH15X198
   b. XH15X192
   c. XH1X52
   d. XH15X199

8. Which part in Fig. 3 of an electric space heater indicates the location of the guide plunger?

   a. XH15X196
   b. XH15X164
   c. XH1X62
   d. XH15X162

9. Which part number in Fig. 3 of an electric space heater shows the location of the grille?

   a. XH15X201
   b. XH11X20
   c. XH15X193
   d. XH20X1

10. Which part number in Fig. 3 of an electric space heater shows the retaining ring?

   a. XT23X328
   b. XH1X43
   c. XH1X41
   d. XH20X1

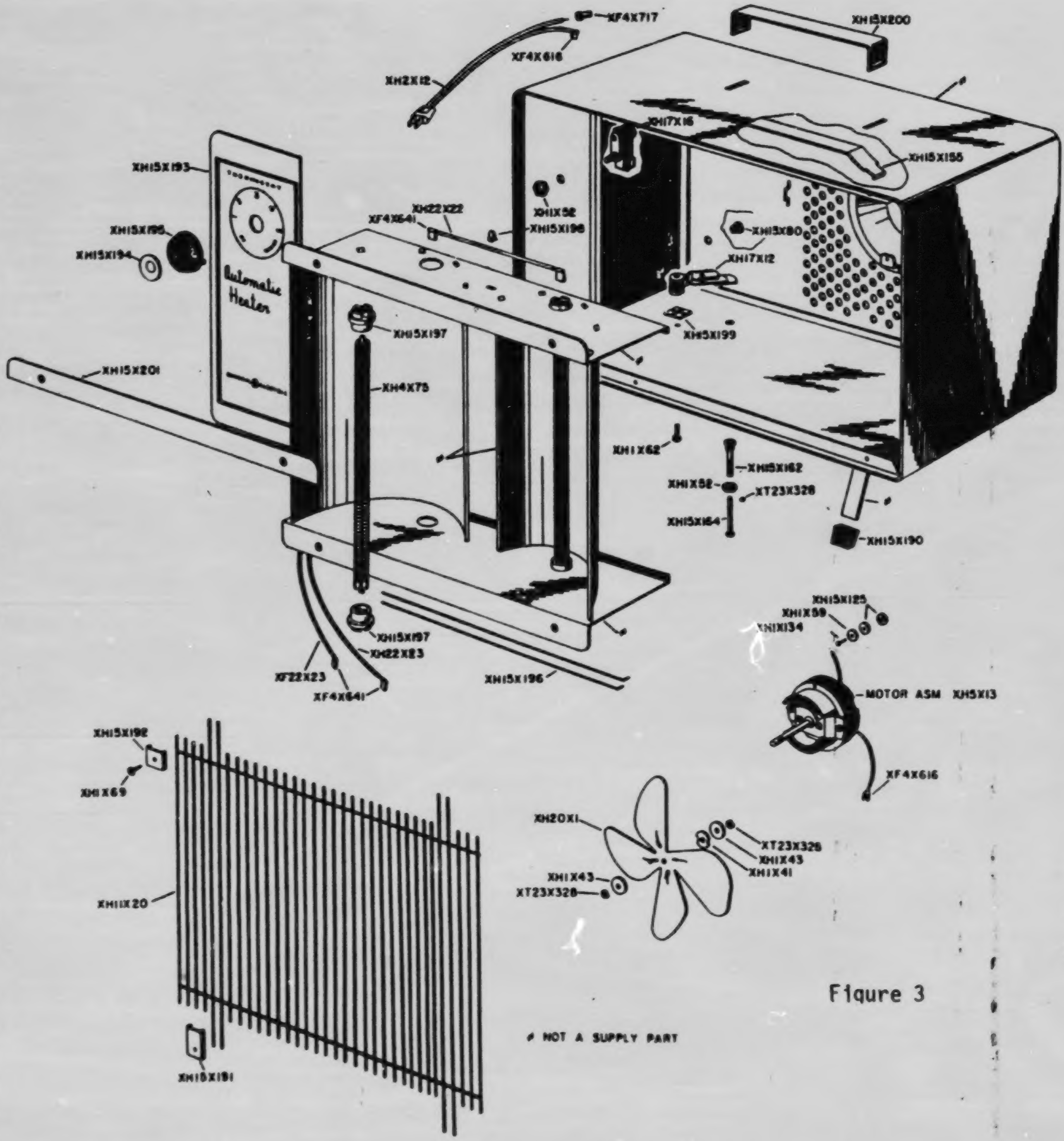

Figure 3

NOT A SUPPLY PART

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File Code: 76.01.03.03.A2-0
Date Published: 8/14/75

Learning Activity Package

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Diagnosis of Malfunctions in an Electric Space Heater

OBJECTIVE:

Diagnose malfunctions in an electric space heater using appropriate tools and procedures.

EVALUATION PROCEDURE:

Electrical values found during diagnosis are consistent with specifications found on the manufacturer's name plate.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Repair, Service and Reassembly of an Electric Space Heater" LAP test and is taken after completing that LAP.

RESOURCES:

Checklist: Diagnosis of Malfunctions - Electric Space Heaters.
Tools, test equipment, work order form and an electric space heater.
Service manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Diagnosis of Malfunctions - Electric Space Heater.

2. Complete the multiple-choice test items for this LAP.

3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s):

T. Ziller

CHECKLIST: DIAGNOSIS OF MALFUCTIONS - ELECTRIC HEATER

______ 1. Complete and attach the work order form to the appliance.

______ 2. Make thorough visual inspection.

______ 3. Check line cords. (Ohmmeter). Resistance: ______

______ 4. Check heating elements. (Ohmmeter) Resistance: ______

______ 5. Check thermostat. (Ohmmeter) Resistance: ______

______ 6. Check switches and controls. (Ohmmeter) Resistance: ______

______ 7. Check condition of element cards.

______ 8. Check mechanical seals, fittings, and connections including knobs, feet, and grommets.

______ 9. Check all electrical connections.

______ 10. Check condition of insulation and bakelite.

______ 11. Plug in to 115V AC power source.

______ 12. Check voltage source. (Voltmeter) Voltage: ______

______ 13. Compute the power, in watts, dissipated by the electric space heater. Compare your computations with the manufacturer's name plate figures. Wattage: ______

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File Code: 76.01.03.04.A2-0
Date Published: 8/14/75

Learning Activity Package

Student: ____________________
Date: ____________________

PERFORMANCE ACTIVITY: Repair, Service and Reassembly of an Electric Space Heater

OBJECTIVE:

Order replacement parts for the electric space heater.

Repair, service and reassemble an electric space heater.

EVALUATION PROCEDURE:

The appliance must operate properly.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Repair, Service and Reassembly -- Electric Space Heater.
Test equipment, tools, appliance parts catalog and requisition form.
An electric space heater
Service manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Repair, Service and Reassembly — Electric Space Heater.
2. Complete the multiple-choice test items for this LAP.
3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s):

T. Ziller

CHECKLIST: REPAIR, SERVICE, AND REASSEMBLY - ELECTRIC SPACE HEATER

Repair and Service:

______ 1. If cord set has faulty insulation, replace with new cord.

______ 2. If temperature control is worn, replace.

______ 3. If bimetallic strip does not open or close properly, adjust set screw for proper clearance.

______ 4. If bimetallic strip is not maintaining the proper temperature setting, replace.

______ 5. If the wires are frayed or corroded, replace or redress.

______ 6. Resolder any connections with silver solder or crimp with uninsulated connectors.

______ 7. If the points are pitted dress with contact file with new strip.

______ 8. If heating element is defective, replace with new element (proper wire and resistance size).

Reassemble:

______ 1. Tighten mounting screws on thermostat.

______ 2. Tighten element terminal mounting nuts.

______ 3. Replace back cover panel and tighten mounting screws.

______ 4. Replace control knob.

LAP TEST ANSWER KEY: DISASSEMBLY OF AN ELECTRIC SPACE HEATER

1. C
2. C
3. B
4. B
5. C
6. D
7. C
8. D
9. B
10. A

76.01.03.03.A2-2

Student: ____________________ File Code: 76.01.03.04.A2-2

Date: ____________________ Date Published: 7/28/75

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LAP TEST: DIAGNOSIS OF MALFUNCTIONS IN AN ELECTRIC SPACE HEATER/REPAIR, SERVICE AND REASSEMBLY OF AN ELECTRIC SPACE HEATER

76.01.03.03

1. In an electric space heater when equipped with a tip-over switch that continues to heat when the heater is tipped over, what should be checked?

   a. the thermostat.
   b. the source of power.
   c. position of switch with relation to plunger.
   d. the fields of the motor.

2. If an electric space heater operates intermittently, check for which of the following?

   a. faulty relay.
   b. faulty capacitor.
   c. faulty thermostat.
   d. faulty transistor.

3. If the fan works on an electric space heater, but there is no heat, check which of the following?

   a. check the resistance on the thermostat.
   b. check resistance of overheat protector switch.
   c. check fuse.
   d. check the line voltage.

4. If heat setting (watts) cannot be changed on an electric space heater, check:

   a. thermopile.
   b. thermocouple.
   c. switch.
   d. thermodynamic.

5. Check defective line cords on an electric space heater with what instrument?

   a. ohmmeter.
   b. voltmeter.
   c. pyrometer.
   d. ammeter

76.01.03.04

6. Which of the following steps should be done first when disassembling an electric space heater?

    a. check resistance of elements.
    b. check voltage drop.
    c. check current draw.
    d. unplug heater from power source.

7. Element replacement in immersion-type space heaters requires the manufacturer's replacement for which of the following reasons?

    a. elements are of fixed current draw.
    b. element assembled within an enclosure.
    c. elements are variable voltage.
    d. element has fixed voltage.

8. Clean the contact area of the electric space heater case with:

    a. alcohol.
    b. glycerin.
    c. gasoline.
    d. oil.

9. How is the bowl-type electric space heater heating element replaced?

    a. remove the housing, install the wire.
    b. remove the line top and install the wire.
    c. remove the set screw and housing and install the wire.
    d. after removal of the guard wire, screw heater element in.

10. When removing the fan or installing a new blade in the fan-type electric space heaters, the track and pitch of the blade should be checked by:

    a. "eyeing up" the blade as they turn around the motor.
    b. placing the fan blade face down on a smooth surface and measuring each blade individually to its highest point.
    c. adjusting pitch at 45^0 degrees.
    d. adjusting track to follow within one inch of the protective shield around the blades.

76.01.03.03.A2-2
76.01.03.04.A2-2

LAP TEST ANSWER KEY: DIAGNOSIS OF MALFUNCTIONS IN AN ELECTRIC SPACE HEATER/ [illegible] REPAIR, SERVICE AND REASSEMBLY OF AN ELECTRIC SPACE HEATER

76.01.03.03

1. C
2. C
3. A
4. C
5. A

76.01.03.04

6. D
7. B
8. A
9. D
10. B

Student: ____________________ File Code: 76.01.03.00.B2-2

Date: ____________________ Date Published: 11/14/74

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UNIT POST TEST: SPACE HEATERS

76.01.03.01

1. The blower-forced space heater will produce heat until:

   a. the blower circuit does more than 2 amps.
   b. the heater circuit does more than 5 amps.
   c. the room temperature increases to a point where the thermostat turns the unit off and on maintaining room temperature.
   d. the thermostat turns on.

2. Some forced-draft space heaters incorporate what, that permits two different heat-setting selections?

   a. two-heat switch.
   b. single pole switch.
   c. three way switch.
   d. four way switch.

3. The amount of heat from a space heater can be varied by:

   a. adjusting the contact points on the thermostat.
   b. connecting heating elements in series or parallel.
   c. adjusting or regulating the current draw.
   d. combining the potential difference of the elements.

4. What device on a space heater cuts the heating element circuit if an overheat condition exists?

   a. overheat protector switch.
   b. thermostat.
   c. relay.
   d. capacitor.

5. With a radiant and fan-forced space heater plugged into a proper power source and the control knob turned clockwise closing the contacts, what elements are energized?

   a. the temperature control and fan motor only.
   b. the heater element only.
   c. the heater element and fan motor only.
   d. heater element, fan motor, temperature control, and tip-over switch.

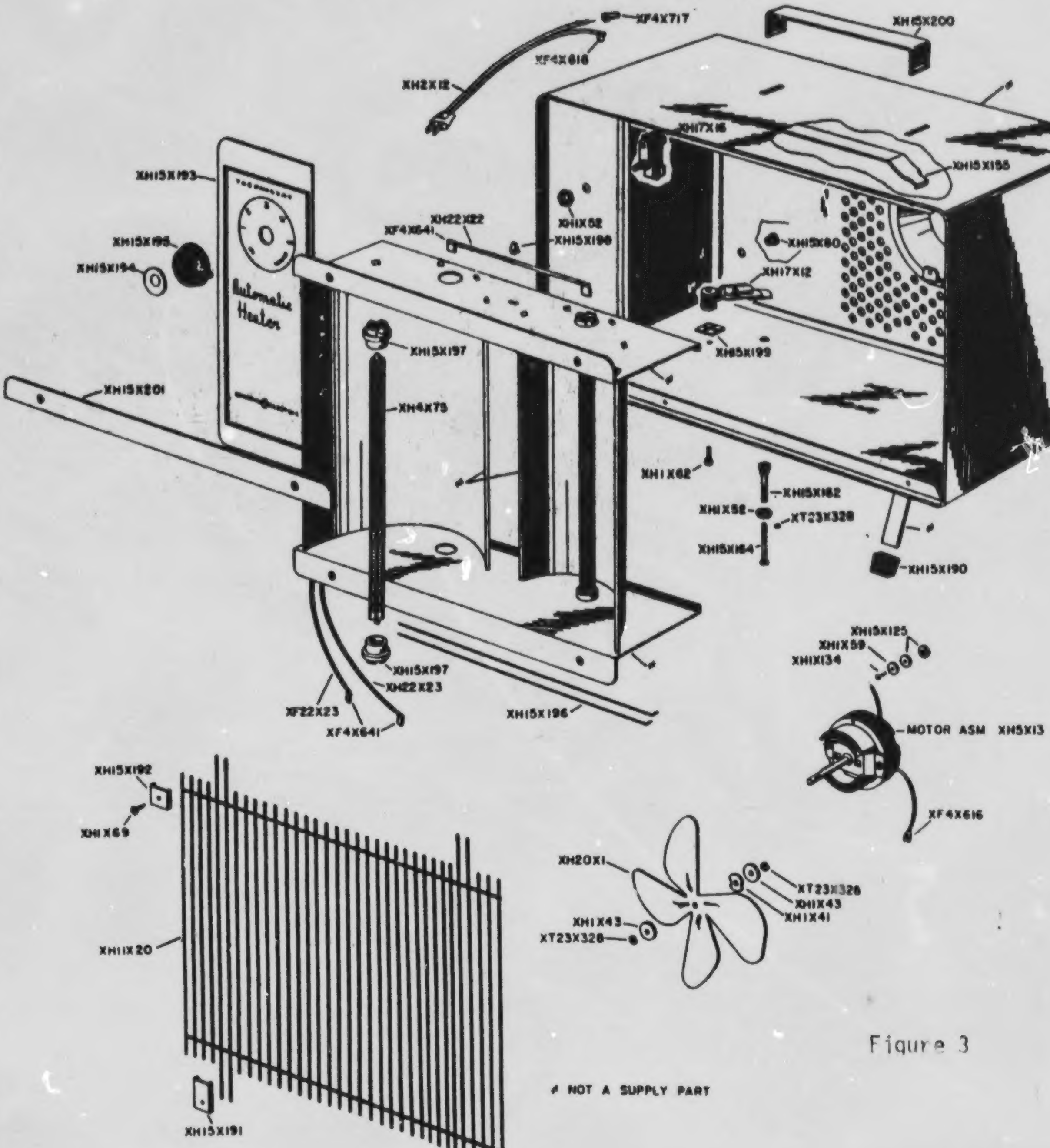

Figure 3

NOT A SUPPLY PART

76.01.03.02

6. Which part number in Fig. 3 shows the location of the thermostat on an electric space heater?

   a. XH4X75
   b. XH15X193
   c. XH17X16
   d. XH15X195

7. Which part number in Fig. 3 shows the location of the heating element on an electric space heater?

   a. XH5X13
   b. XH4X75
   c. XF4X641
   d. XH22X22

8. Which part number in Fig. 3 (electric space heater) indicates the location of the motor assembly?

   a. XF4X616
   b. XH5X13
   c. XH20X1
   d. XH17X16

9. Which part number in Fig. 3 (electric space heater) indicates the location of the strain relief?

   a. XF4X717
   b. XH15X80
   c. XH15X192
   d. XH15X191

10. Which part number in Fig. 3 (electric space heater) shows the location of the blade?

   a. XH5X13
   b. XH11X20
   c. XH20X1
   d. XH4X75

76.01.03.03

11. If an electric space heater requires a motor field check, what voltage source would be used?

   a. 110 volts.
   b. 3.5 volts.
   c. 200 volts.
   d. 440 volts.

76.01.03.03 (continued)

12. If an electric space heater is operating noisily, check for which of the following?

    a. high resistance draw.
    b. high voltage drop.
    c. binding or striking.
    d. line source is faulty.

13. If the switch contacts on an electric space heater are touching the plunger, with the plunger all the way out, what procedure must be followed?

    a. use a high voltage to oil the points.
    b. use a rasp and repair the points.
    c. replace the points on the switch.
    d. switch must be replaced.

14. The first step in diagnosing malfunctions in space heaters is:

    a. thorough visual inspection.
    b. check resistance of the relay.
    c. check resistance of the capacitor.
    d. check voltage drop.

15. Check defective line cords on an electric space heater with what instrument?

    a. ohmmeter.
    b. voltmeter.
    c. pyrometer.
    d. ammeter.

76.01.03.04

16. In order to obtain the correct heating valve in a new heating element on a bowl-type electric space heater, check:

    a. wattage rating of the element of the heater nameplate.
    b. resistance rating of the thermostat on the nameplate.
    c. amperage rating of the element on the nameplate.
    d. voltage rating of the element on the nameplate.

17. Replacement of heating elements in convection-type electric space heaters usually requires:

    a. removal of all electrical wires.
    b. removal of the bottom panel.
    c. removal of the thermostat.
    d. removal of all the screws.

76.01.03.04 (continued)

18. After determining the heating element is defective in a convection-type electric space heater, first:

    a. disconnect the thermostat.
    b. replace the heating element.
    c. disconnect the wires from their terminals.
    d. replace the electric cord.

19. When replacing the screw-in heater element on a bowl-type electric space heater, carefully tighten to avoid arcing when in use. If this precaution is not taken, what will be the result?

    a. an explosion.
    b. damage to the heater unit itself.
    c. a direct short circuit.
    d. a direct open circuit.

20. When removing the fan or installing a new blade in the fan-type electric space heaters, the track and pitch of the blade should be checked by:

    a. "eyeing up" the blades as they turn around on the motor.
    b. placing the fan blade face down on a smooth surface and measuring each blade individually to its highest point.
    c. adjusting pitch to 45^o degrees.
    d. adjusting track to follow within one inch of the protective shield around the blades.

UNIT TEST ANSWER SHEET

POST TEST

Occupational Area: ______________________

File Code: 76.01.03.00.B2-2

Name: ______________________

ANSWERS

76.01.03.01	1.	C	21.		41.	
	2.	A	22.		42.	
	3.	B	23.		43.	
	4.	A	24.		44.	
	5.	D	25.		45.	
5.01.03.02	6.	C	26.		46.	
	7.	B	27.		47.	
	8.	B	28.		48.	
	9.	B	29.		49.	
	10.	C	30.		50.	
76.01.03.03	11.	B	31.		51.	
	12.	C	32.		52.	
	13.	D	33.		53.	
	14.	A	34.		54.	
	15.	A	35.		55.	
5.01.03.04	16.	A	36.		56.	
	17.	B	37.		57.	
	18.	C	38.		58.	
	19.	B	39.		59.	
	20.	B	40.		60.	

Student: ____________________ **File Code:** 76.01.03.00.A1-5

Date: ____________________ **Date Published:** 11/12/74

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Glasgow AFB, Montana 59231

Family Pay Number: __________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: SPACE HEATERS

OBJECTIVE 1:

Given a malfunctioning space heater, the student will service and repair the space heater so that it functions according to the manufacturer's specifications, following safe practices and procedures.

OBJECTIVE 2:

Using appropriate tools and test equipment, the student will calculate and record amperage, voltage, resistance, and wattage of a space heater.

TASK:

The student will service and repair a malfunctioning space heater and, in the process, he will take and record amperage, voltage, resistance and wattage reading, using appropriate test equipment.

ASSIGNMENT:

CONDITIONS:

The student will be given a malfunctioning space heater (it may be bugged by the instructor or it may be one brought in by a customer). He will be required to service and repair the space heater in conditions similar to those in a typical appliance repair shop. He will be allowed to use any and all tools, equipment, service manuals, text books, etc., commonly found in a repair shop. He must complete it in a reasonable length of time with no assistance from the instructor(s) or students.

RESOURCES:

Tools:
- Amprobe RS-3 Rotary Meter (B-A)
- Soldering gun 100 to 140 Watt
- Adjustable Wrench
- Nut Driver Set
- Long Nose Pliers
- Diagonal Cutters
- Slip Joint Pliers
- Screwdriver Set
- Phillips Set
- Hex & Spline Wrench Kit
- Vise Grip Plier Model Size 7"
- Utica Electrician's Knife, Standard Size
- 18" Aluminum Level
- 12' Steel Tape
- Punch & Chisel Set, 1/2", 5/8" chisels; 3/16, 3/8, 5/32 punches
- Combination Wrench Set
- Hammer (Ball Peen) 12 oz.
- 10" Channel-lock Plier
- Utility Box
- VOM
- Assortment of wire, fasteners, and repair parts
- Space Heater

Printed Material:

- Various Repair Manuals
- Manufacturer's Specifications

Student: ______________________ File Code: 76.01.03.00.A1-5

Date: ______________________ Date Published: 11/12/74

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Family Pay Number: __________ Sex M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Follows safe practices and procedures.		
Criterion: No injury results to the student or the equipment and		
complies with OSHA requirements.		
2. Follows proper procedures for disassembly.		
Criterion: No damage results to the appliance.		
3. Diagnosis and troubleshoots malfunctions properly.		
Criterion: When repaired, the appliance functions according to the		
manufacturer's specifications.		
4. Reassembles the appliance properly.		
Criterion: Appliance functions according to the manufacturer's		
specifications and the procedures followed agree with		
those described in the service literature.		
5. The repaired appliance is repaired in a neat,		
professional manner.		

(Checklist continued)

	CRITERION Met	 Not Met
Criterion: No damage results to the appliance such as scratches and dents.		
6. All connections and fastening are properly completed.		
Criterion: The appliance connection complies with the manufacturer's		
specifications. The connection is mechanically fastened		
and structurally sound. The connection is electrically		
fastened and free of defects.		
7. Appliance functions according to the manufacturer's		
specifications.		
Criterion: Manufacturer's Specifications		
8. Uses appropriate repair part and supplies.		
Criterion: They match exactly those listed in the manufacturer's		
specifications.		
Objective 2:		
9. Uses test equipment properly.		
Criterion: Manufacturer's Specifications		
10. Wattage readings are accurate.		
Criterion: Manufacturer's Specifications.		
11. Voltage readings are accurate		
Criterion: Manufacturer's Specifications.		

(Checklist continued)

	CRITERION	
	Met	Not Met
12. Amperage readings are accurate.		
Criterion: Manufacturer's Specifications.		
13. Resistance readings are accurate.		
Criterion: Manufacturer's Specifications.		
14. When applicable mathematical calculations are correct.		
Criterion: AC/DC Circuit Manuals, Westinghouse		
15. The appliance is repaired in a reasonable time.		
Criterion: Not to exceed 1 hour.		
The student must complete 13 out of 15 line items to achieve		
an overall score of satisfactory.		

File Code: 76.01.04.00.A2-1

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Mountain-Plains Education &
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Learning Experience Guide

UNIT: WATER HEATERS

RATIONALE:

Appliance Service persons are often asked to repair water heaters. To do this effectively, this person must understand the operation and function of water heater parts. A service person must understand basic troubleshooting procedures to find specific problems in heaters. This unit will help do this.

PREREQUISITES:

The following units are to be completed before beginning this unit.

76.01.03 Unit: Roasters

77.01.06 Unit: Parallel Circuits

OBJECTIVES:

Operate; disassemble; diagnose malfuctions; repair, replace or service component parts; and reassemble a water heater when given service manuals and tools.

RESOURCES:

Printed Materials

Appliance Service Manuals for appliances used in the program.
Catalogs, appliance supply (assortment).
Home Appliance Servicing. Edwin P. Anderson, 2nd Edition, Theodore Audel and Company, Indianapolis, Indiana, 1965.
Order forms.
Work order forms.
Manufacturer's specification sheets.

Equipment

Test Equipment: Amprobe (RS-3 Rotary Meter B-A).
Meter, volt-ohm.

Principal Author(s): T. Ziller

Tools:

Box, utility.
Chisels, (½" and 5/8").
Cutters, diagonal.
Gun, Soldering (100-140 watt).
Hammer, ball pein (12 0z.).
Kit, solderless terminal.
Knife, electricians.
Level, aluminum 18".
Nut driver set.
Pliers, channel-lock (10").
Plier, long nose.
Plier, slip joint.
Plier, vise grip (size 7").
Puncher, (3/16", 3/8" & 5/32").
Screwdriver, blade (set).
Screwdriver, Phillips (set).
Tape, steel measuring (12 ft.).
Wrench, adjustable.
Wrench, combination set.
Wrench, hex & spline (kit).

GENERAL INSTRUCTIONS:

This unit consists of eight Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(9) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Operation of an Electric Water Heater
.02 Disassembly of an Electric Water Heater
.03 Diagnosis of Malfunctions in an Electric Water Heater

.04 Repair, Service and Reassembly of an Electric Water Heater
.05 Operation of a Gas Water Heater.
.06 Disassembly of a Gas Water Heater.
.07 Diagnosis of Malfunctions in a Gas Water Heater.
.08 Repair, Service and Reassembly of a Gas Water Heater

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed critieria for the performance test.

FOLLOW-THROUGH:

After reading this unit guide, obtain the LAP for the first assigned performance activity.

Student: ______________________ File Code: 76.01.04.00.A2-2

Date: ______________________ Date Published: 11/15/74

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UNIT PRETEST: WATER HEATERS

76.01.04.01

1. What would happen to an electric water heater if the power was turned on with no water in the tank?

   a. pressure-relief valve will open.
   b. heating elements would burn out.
   c. pressure-relief valve will close.
   d. nothing.

2. All water heater tanks are cylindrical in shape with convex bottoms that:

   a. permits flushing or draining.
   b. permits a high pressure hot water system.
   c. keeps the tank from corroding.
   d. keeps ballast between cold and hot water.

3. In an electric water heater a double-throw thermostat is required only in which of the following?

   a. single-heating element.
   b. double-heating element.
   c. double and single-heating element.
   d. triple-heating element.

4. The electric water heater tank is filled with cool water and a double-throw thermostat completes the circuit to the upper element causing which of the following to happen?

   a. opens the upper element.
   b. connects the lower element.
   c. disconnects the lower element.
   d. shorts the lower element.

5. When the water in the upper part of the electric water heater tank is heated, which thermostat switch disconnects the upper element and connects the lower element to heat the remainder of the water in the tank?

   a. double-throw thermostat.
   b. single-throw thermostat.
   c. single-pole double-throw thermostat.
   d. double-pole single-throw thermostat.

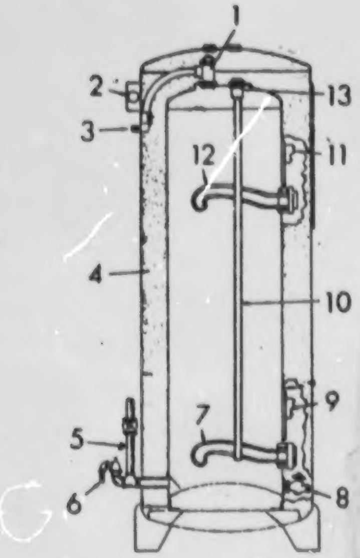


Figure 4

The principal components of a round-shell electric water heater.

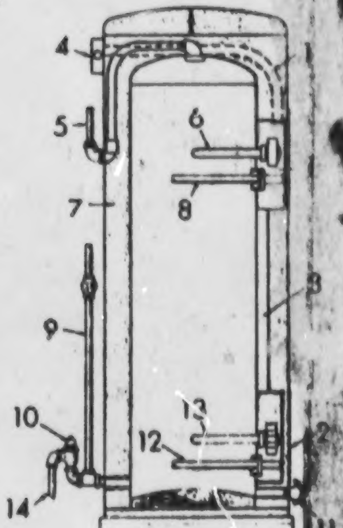


Figure 5

Construction features of a typical round-shell electric water heater.

76.01.04.02

6. In the illustration (Fig. 4) of an electric heater locate by number the hot water outlet.

   a. 8
   b. 5
   c. 6
   d. 3

7. In the illustration (Fig. 4) of an electric heater locate by number the tee connection.
   a. 1
   b. 13
   c. 2
   d. 3

8. In the illustration (Fig. 4) of an electric heater locate by number the male-female plug.

   a. 11
   b. 13
   c. 2
   d. 3

9. In the illustration (Fig. 4) of an electric heater locate by number the upper heating unit.

   a. 11
   b. 3
   c. 12
   d. 4

10. In the illustration (Fig. 4) of an electric water heater, what number indicates the lower heating unit?

   a. 7
   b. 9
   c. 10
   d. 5

76.01.04.03

11. If an electric water heater is noisy, what would be the possible cause?

   a. stuck water valve.
   b. continuity in the resistive element.
   c. open circuit.
   d. poor insulation.

76.01.04.03 (continued)

12. The manual reset, trip-free temperature limiting devices on a particular electric water heater will cut off all power to heater if:

    a. temperature of water exceeds 150°F.
    b. temperature of water exceeds 190°F.
    c. temperature of water exceeds 300°F.
    d. temperature of water exceeds 212°F.

13. If there is not hot water coming from an electric water heater after a reasonable amount of time, what is the possible cause?

    a. thermostat contact points are shorted.
    b. pilot light is out.
    c. a fuse may be blown.
    d. thermostat contact points are open.

14. If there is blocking or freezing in the relief pipe on an electric water heater, what would cause this?

    a. thermostat set too high.
    b. water may be too cold.
    c. thermostat set too low.
    d. improper location of water heater.

15. On a limited-demand electric water heater, if the top element malfunctions what is the possible cause?

    a. voltmeter.
    b. pyrometer.
    c. ohmmeter.
    d. ammeter.

76.01.04.04

16. When replacing the insulation over the controls after thermostat adjustment on an electric water heater, check:

    a. snugness of thermostat contact points.
    b. screw adjustments for tightness.
    c. that controls are well covered and that the plastic terminal shield has not been displaced.
    d. switching mechanism for timing.

17. What procedure should be followed to drain the electric water heater?

    a. turn power up to aid in draining the tank.
    b. turn up thermostat to pressurize tank.
    c. turn down thermostat to depressurize tank.
    d. shut off power supply, close cold water inlet valve, open a hot water faucet, and open the drain valve.

76.01.04.04 (continued)

18. What procedure should be followed to check the temperature-pressure relief valve on an electric water heater?

    a. raise the test lever at the top of this valve to make certain that water ways are clear.
    b. shake the tank to check its ballast.
    c. turn on the hot water faucet.
    d. turn on the cold water faucet.

19. Where it is necessary or required by code to install a check valve in the cold water line for an electric water heater, what procedure should be followed?

    a. check valve must be installed between the tank.
    b. a pressure relief valve must be installed after the check valve.
    c. a pressure relief valve must be installed between the check valve and the heater.
    d. check valve must be installed after the tank.

20. How should the insulation on an electric water heater be removed to allow access to the thermostat?

    a. with rubber gloves.
    b. fold the insulation outward away from the controls.
    c. with a hemostat.
    d. fold the insulation inward toward the controls.

76.01.04.05

21. Gas burners on a instantaneous gas water heater are usually equipped with a gauge to:

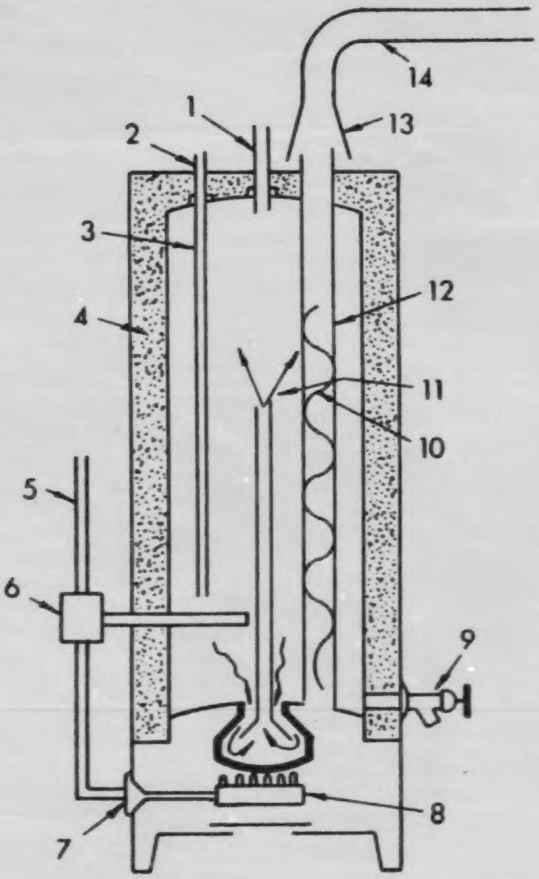
    a. indicate amount of gas being used.
    b. override switches.
    c. protect the flame from backflash.
    d. indicate amount of water being heated.

22. For the snap-action thermostat to operate properly, the valve gap must be adjusted so that:

    a. the contacts open and close.
    b. the valve does not open or close while the clicker is being moved by the Invard rod.
    c. the valve opens only when the thermostat closes.
    d. the valve closes only when the thermostat opens.

23. The activated spring-loaded safety catch on an automatic gas water heater snaps back into position if:

    a. the switching mechanism is shorted.
    b. the opened switch is deactivated.
    c. the pilot-thermocouple combination does not produce enough current to create the necessary magnetic holding power.



AUTOMATIC GAS WATER HEATER
STORAGE TYPE

Figure 6

76.01.04.05 (continued)

24. If pressure is applied to the main valve on an automatic gas water heater, what happens to the valve?

    a. closes and stops the flow of gas to the main burner.
    b. opens and closes, allowing gas to flow to the main burner.
    c. causes the thermocouple to engage.
    d. shorts the thermostats contacts.

25. What device on an automatic gas water heater is used to relieve excessive pressure in the heating system?

    a. pressure-relief valve.
    b. shut-off valve.
    c. gas regulator.
    d. thermocouple.

76.01.04.06

26. During disassembling the gas water heater (Fig. 6), the point of circulation would be:

    a. 10
    b. 11
    c. 8
    d. 12

27. In the disassembly view of a gas water heater (Fig. 6) number 14 indicates the location of:

    a. flue.
    b. circulation pipe.
    c. pipe to chimney.
    d. drawoff.

28. In (Fig. 6) of a gas water heater locate the insulation.

    a. 11
    b. 10
    c. 4
    d. 12

29. In disassembling the gas water heater (Fig. 6) the thermostat would be located where?

    a. 8
    b. 7
    c. 6
    d. 4

76.01.04.06 (continued)

30. Locate the flue in (Fig. 6) of a gas water heater.

    a. 13
    b. 14
    c. 11
    d. 12

76.01.04.07

31. If the gas water heater bills are too high, check:

    a. improper selection of a heater for the hot water requirements of the house.
    b. the burner for leakage.
    c. the pilot flame adjustment.
    d. improper gas pressure.

32. If the gas water heater water temperature exceeds 140°F, check:

    a. thermocouple current.
    b. thermostat setting(s).
    c. pilot flame adjustment.
    d. burner flame adjustment.

33. If there is improper burning of the gas on a gas water heater, check:

    a. gas leak.
    b. burner flame adjustment.
    c. gas pressure.
    d. air shutter.

34. If there is a soot formation on the gas water heater, check:

    a. air shutter.
    b. flue.
    c. gas pressure.
    d. for dirty orifice.

35. If there is noisy operation of the gas water heat and sediment in the water lines, check:

    a. relief valve.
    b. water source.
    c. back pressure valve.
    d. drain.

76.01.04.08

36. The proper air-gas mixture on a gas water heater is obtained by:

    a. controlling the input temperature setting.
    b. adjusting the gas pressure on the main valve.
    c. changing the orifice setting.
    d. adjusting the air shutter on the mixer face of the main burner.

37. For proper burning of gas on a gas water heater, adjust by:

    a. loosening the air shutter nut, rotating shutter to close the opening in the burner, then slowly rotating shutter until the yellow tips disappear.
    b. turning the main valve counterclockwise until flame height is 3/16"
    c. controlling the gas metering valve with a set screw.
    d. rotating the thermopiles elements until they turn red.

38. If the gas water heater is installed in an enclosed area, what must be provided?

    a. three ventilation openings.
    b. one ventilation openings.
    c. two ventilation openings.
    d. four ventilation openings.

39. What is the installation procedure for location of a gas water heater?

    a. location accessible to water and gas supply lines near the chimney where the floor is level.
    b. near a drain for draining purposes.
    c. near a window for ventilation purposes.
    d. near an electrical source for safety purposes.

40. What is the installation procedure for connecting the draft diverter to the chimney flue pipe for a gas water heater?

    a. the chimney flue pipe should be the same diameter as the outlet of the diverter and using the least number of vent pipe elbows possible.
    b. chimney diameter should be larger than outlet of the heater for vent purposes.
    c. the director should be smaller then the heater vent outlet.
    d. draft director should not exceed 1' in length for proper connection and safety.

UNIT TEST ANSWER SHEET
PRETEST

Occupational Area: ____________________
File Code: 76.01.04.00.A2-2
Name: ____________________

ANSWERS

76.01.04.01	1.	B ______	76.01.04.05	21.	C ______	41.	______
	2.	A ______		22.	B ______	42.	______
	3.	B ______		23.	C ______	43.	______
	4.	C ______		24.	A ______	44.	______
	5.	A ______		25.	A ______	45.	______
6.01.04.02	6.	D ______	76.01.04.06	26.	B ______	46.	______
	7.	A ______		27.	C ______	47.	______
	8.	B ______		28.	C ______	48.	______
	9.	C ______		29.	C ______	49.	______
	10.	A ______		30.	D ______	50.	______
76.01.04.03	11.	A ______	76.01.04.07	31.	A ______	51.	______
	12.	B ______		32.	B ______	52.	______
	13.	C ______		33.	D ______	53.	______
	14.	D ______		34.	A ______	54.	______
	15.	C ______		35.	D ______	55.	______
76.01.04.04	16.	C ______	76.01.04.08	36.	D ______	56.	______
	17.	D ______		37.	A ______	57.	______
	18.	A ______		38.	C ______	58.	______
	19.	C ______		39.	A ______	59.	______
	20.	B ______		40.	A ______	60.	______

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File Code: 76.01.04.01.A2-0

Date Published: 8/15/75

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: Operation of an Electric Water Heater

OBJECTIVES:

Describe the operation of an electric water heater.

Draw schematic diagram of the electrical circuit for the water heater.

EVALUATION PROCEDURE:

Student is to write a description about the operation of an electric water heater that is consistent with the attached checklist.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Operation of an Electric Water Heater
Electric Water Heater
Home Appliance Servicing, Anderson.

PROCEDURE:

1. Read and study carefully the information found on pages 158-173 in Home Appliance Servicing.
2. Operate the appliance and observe the characteristics of the appliance following the steps listed on the attached operational checklist.
3. Describe the operation of an electric water heater and draw a simple schematic of the circuit.
4. Complete the multiple-choice test items for this LAP.
5. Check your answers with the test key. If your answers are all correct,

Principal Author(s):

record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items you may record your time on your SPR.

CHECKLIST: OPERATION OF AN ELECTRIC WATER HEATER

_____ 1. Check all water outlets, gaskets and valves.

_____ 2. Connect water heater to a cold water tap and fill tank.

_____ 3. Check pressure release valve for proper water level.

NOTE: Water should drain out when valve is released.

_____ 4. Connect electrical power to water heat (230V 60Hz 30A).

_____ 5. Adjust thermostats with screwdriver to mid range.

NOTE: The water heater is now operating. The top thermostat is a DPDT switch which connects the top element to the circuit and disconnects the bottom element.

**Let operate approximately 20 minutes.

_____ 6. Adjust top termostat to a lower degree setting.

NOTE: The DPDT thermostat has now switched "off" the upper element and has switched "on" the lower element through a series connected SPST thermostat which has been "on" since the operation began.

_____ 7. Adjust lower thermostat to a lower setting.

NOTE: Water heater should now be "off". (The temperature should be maintained at about 165^{o} to 185^{o})

_____ 8. Disconnect from power and water source.

Student: ______________________ File Code: 76.01.04.01.A2-2

Date: ______________________ Date Published: 11/15/74

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LAP TEST: OPERATION OF AN ELECTRIC WATER HEATER

1. What would happen to an electric water heater if the power was turned on with no water in the tank?

   a. pressure-relief valve will open.
   b. heating elements would burn out.
   c. pressure-relief valve will close.
   d. nothing.

2. The water heater tank capacity may vary and is:

   a. dependent on water pressure.
   b. directly dependent on the hot water demand.
   c. independent of hot water demand.
   d. independent of hot water supply.

3. All water heater tanks are cylindrical in shape with convex bottoms that:

   a. permits flushing or draining.
   b. permits a high pressure hot water system.
   c. keeps the tank from corroding.
   d. keeps ballast between cold and hot water.

4. The heating effect of a water heater depends on the:

   a. water pressure in the water system.
   b. water pressure in the heating tank.
   c. wattage of the unit in question.
   d. wattage of the power system.

5. Name the thermostat switch in an electric water heater that is connected in series with the lower heating element and has only one set of contacts.

   a. compound double-throw thermostatic switch.
   b. double-throw thermostatic switch.
   c. compound single-throw thermostatic switch.
   d. single-throw thermostatic switch.

6. In an electric water heater a double-throw thermostat is required only in which of the following?

   a. single-heating element.
   b. double-heating element.
   c. double- and single-heating element.
   d. triple-heating element.

7. When an electric water heater refills with water, water is fed in the heating tank at which of the following points?

   a. top only.
   b. bottom only.
   c. simultaneously top/bottom.
   d. middle only.

8. Under what condition would the upper element thermostat switch on to heat the water in the upper portion of the electric water heater tank?

   a. a large amount of heated water is used.
   b. a large amount of cold water is used.
   c. a small amount of heated water is used.
   d. a small amount of cold water is used.

9. When the water in the upper part of the electric water heater tank is heated, which thermostat switch disconnects the upper element and connects the lower element to heat the remainder of the water in the tank?

   a. double-throw thermostat.
   b. single-throw thermostat.
   c. single pole double-throw thermostat.
   d. double pole single-throw thermostat.

10. When heated water is withdrawn from the electric water heater and replaced by cold water, which thermostat switch connects the lower element and heats the incoming water?

   a. single pole double-throw thermostat.
   b. double pole double-throw thermostat.
   c. single-throw thermostat.
   d. double-throw thermostat.

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Disassembly of an Electric Water Heater

OBJECTIVES:

Disassemble and identify the parts of an electric water heater.

EVALUATION PROCEDURE:

Instructor will examine the disassembled appliance for correct disassembly and parts identification in accordance with the attached checklist.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Disassembly of an Electric Water Heater
Tools and electric water heater
Service manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Disassembly of an Electric Water Heater.
2. Complete the multiple-choice test items for this LAP.
3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): P. Schuster, T. Ziller

CHECKLIST: DISASSEMBLY OF AN ELECTRIC WATER HEATER

_____ 1. Turn off power.

_____ 2. Remove front cover screws and cover.

_____ 3. Fold insulation back. (Heating units and thermostats will now be exposed.)

_____ 4. Disconnect wires from heating units.

_____ 5. Remove retaining nuts and heating units using care not to ruin gaskets.

_____ 6. Disconnect wires and remove thermostats.

_____ 7. Disconnect and remove wires from terminal (junction) box.

_____ 8. Identify each part by labeling it.

_____ 9. Have the instructor check the identification.

LAP TEST ANSWER KEY: OPERATION OF AN ELECTRIC WATER HEATER

1. B
2. B
3. A
4. C
5. D
6. B
7. B
8. A
9. A
10. C

Student: ______________________ File Code: 76.01.04.02.A2-2

Date: ______________________ Date Published: 7/28/75

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LAP TEST: DISASSEMBLY OF AN ELECTRIC WATER HEATER

1. In Fig. 4 locate by number the exact location of the magnesium rod in the electric water heater.

   a. 6
   b. 7
   c. 1
   d. 10

2. In Fig. 4 which number would locate the cold water inlet found on an electric water heater?

   a. 6
   b. 5
   c. 3
   d. 7

3. In the illustration of an electric water heater (Fig. 4) locate by number the location of the single-throw thermostat.

   a. 13
   b. 6
   c. 9
   d. 1

4. In the illustration of an electric water heater (Fig. 4) locate by number the location of the junction box.

   a. 2
   b. 1
   c. 13
   d. 11

5. In the illustration of an electric water heater (Fig. 4) locate by number the location of the double-throw thermostat.

   a. 13
   b. 9
   c. 1
   d. 11

6. In the illustration (Fig. 4) of an electric heater locate by number the hot water outlet.

   a. 8
   b. 5
   c. 6
   d. 3

7. In the illustration (Fig. 4) of an electric heater locate by number the male-female plug.

   a. 11
   b. 13
   c. 2
   d. 3

8. In the illustration (Fig. 4) of an electric heater locate by number the upper heating unit.

   a. 11
   b. 3
   c. 12
   d. 4

9. In the illustration (Fig. 4) of an electric water heater, what number indicates the lower heating unit?

   a. 7
   b. 9
   c. 10
   d. 5

10 In the illustration (Fig. 5) of an electric water heater, what number indicates the control panel?

   a. 4
   b. 2
   c. 1
   d. 12

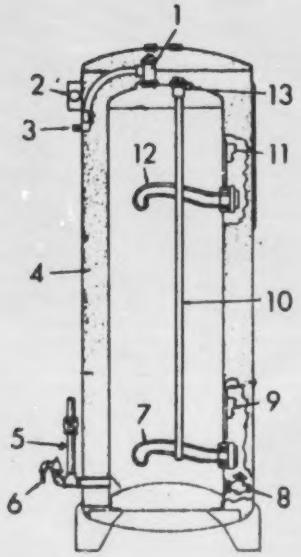

Figure 4

The principal components of a round-shell electric water heater.

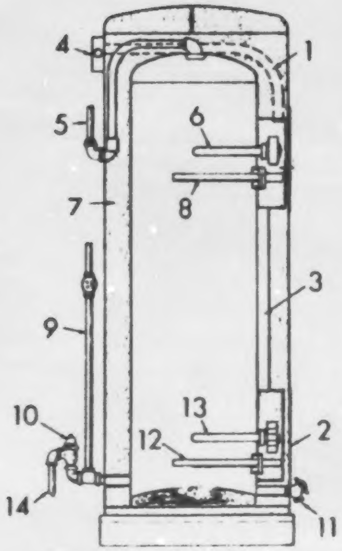

Figure 5

Construction features of a typical round-shell electric water heater.

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File Code: ~~76.01.04.03.A2-0~~
Date Published: 8/15/75

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: Diagnosis of Malfunctions in an Electric Water Heater

OBJECTIVE:

Diagnose malfunctions in an electric water heater using appropriate tools and procedures.

EVALUATION PROCEDURE:

Electrical values found during diagnosis are consistent with specifications found on the manufacturer's name plate.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Diagnosis of Malfunctions - Electric Water Heater
Tools, test equipment, work order form and an electric water heater.
Service manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Diagnosis of Malfunctions - Electric Water Heater.

2. Complete the multiple-choice test items for this LAP.

3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): P. Schuster, T. Ziller

76.01.04.03.A2-0

CHECKLIST: DIAGNOSIS OF MALFUNCTIONS
- ELECTRIC WATER HEATER

______ 1. Complete work order form.

______ 2. Make a thorough visual inspection.

______ 3. Check power sources. (Voltmeter) Voltage: ______

______ 4. Check line cords. (Ohmmeter) Resistance: ______

______ 5. Check heating elements. (Ohmmeter) Resistance: ______

______ 6. Check thermostat. (Ohmmeter for continuity) Resistance: ______

______ 7. Check switches and controls. (Ohmmeter) Resistance: ______

______ 8. Check condition of heating elements.

______ 9. Check mechanical seals, fittings, and connections including knobs, feet and grommets.

______ 10. Check all electrical connections.

______ 11. Check condition of insulation and bakelite.

______ 12. Plug in electric water heater to 230 VAC. (30 amp)

______ 13. Take a voltage reading. Voltage: ______

______ 14. Take a current reading with an amprobe or an ammeter. Current: ______

______ 15. Compute power being dissipated and compare your figures with the figures on the manufacturer's name plate. Wattage: ______

LAP TEST ANSWER KEY: DISASSEMBLY OF AN ELECTRIC WATER HEATER

1. D
2. B
3. C
4. A
5. D
6. D
7. B
8. C
9. A
10. B

Student: ______________________________ **File Code:** 76.01.04.03.A2-2

Date: ______________________________ **Date Published:** 7/28/75

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LAP TEST: DIAGNOSIS OF MALFUNCTIONS IN AN ELECTRIC WATER HEATER

1. The electric water heater temperature may easily be checked by:

   a. using an ammeter in series.
   b. holding a thermometer under an open hot water faucet.
   c. using a barometer for displacement.
   d. using a voltmeter in parallel.

2. Failure to install the proper temperature-pressure relief valve in an electric water heater may cause:

   a. excessive temperature and pressures.
   b. minimum temperature and pressures.
   c. excessive current in the circuit.
   d. minimum power dissipation.

3. Heat deficiency from an electric water heater may be caused by:

   a. too much insulation on pipe.
   b. high thermostat setting.
   c. low thermostat setting.
   d. too extensive run of pipe.

4. When one electric water heater is unable to meet the hot water nonlimited-demand, what method may be used to remedy this?

   a. one full service demand in series.
   b. two similar electric water heaters in parallel.
   c. one limited demand in series.
   d. two similar electric water heaters in series.

5. The first step for diagnosing malfunctions in an electric water heater is:

   a. voltage reading.
   b. thorough visual inspection.
   c. current reading.
   d. fire inspection.

6. Why would it be necessary to completely drain the electric water heater?

   a. installing to electrical power.
   b. check for leaks.
   c. change elements.
   d. flush sediment and lime buildup in the bottom of the tank.

7. If an electric water heater is noisy, what would be the possible cause?

   a. stuck water valve.
   b. continuity in the resistive element.
   c. open circuit.
   d. poor insulation.

8. If there is blocking or freezing in the relief pipe on an electric water heater, what would cause this?

   a. thermostat set too high.
   b. water may be too cold.
   c. thermostat set too low.
   d. improper location of water heater.

9. To check for an open bottom heater element on an electric water heater, what instrument would be used?

   a. voltmeter.
   b. pyrometer.
   c. ohmmeter.
   d. ammeter.

10. On a limited-demand electric water heater, if the top element malfunctions what is the possible cause?

    a. not enough hot water.
    b. too much hot water.
    c. no hot water.
    d. ample amount of hot water.

LAP TEST ANSWER KEY: DIAGNOSIS OF MALFUNCTIONS IN AN ELECTRIC WATER HEATER

1. B
2. A
3. D
4. B
5. B
6. D
7. A
8. D
9. C
10. C

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File Code: 76.01.04.04 A2-0

Date Published: 8/13/75

Learning Activity Package

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Repair, Service and Reassembly of an Electric Water Heater

OBJECTIVES:

Order replacement parts for an electric water heater.

Repair, service and reassemble an electric water heater.

EVALUATION PROCEDURE:

The appliance must operate properly.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Checklist: Repair, Service and Reassembly - Electric Water Heater
Test equipment, tools, appliance parts catalog, and requisition form.
Electric water heater.
Service manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Repair, Service and Reassembly - Electric Water Heater.
2. Complete the multiple-choice test items for this LAP.
3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): P. Schuster, T. Ziller

CHECKLIST: REPAIR, SERVICE, AND REASSEMBLY - ELECTRIC WATER HEATER

Repair and Service:

_____ 1. If power fuses or breakers are faulty, replace.

_____ 2. If elements are higher or lower in resistance replace with same wattage.

_____ 3. If gasket material is cracked, replace and seal.

_____ 4. If top thermostat (DPDT) is faulty, replace with same type.

_____ 5. If lower thermostat (SPST) is inoperative, replace with same type.

_____ 6. If wiring insulation is worn or marred, replace with new wire or reinsulate wire.

Reassemble:

_____ 1. Replace and tighten all element mounting bolts.

_____ 2. Tighten all terminal screws and wire nuts.

_____ 3. Replace cover access plates and tighten mounting screws.

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LAP TEST: REPAIR, SERVICE AND REASSEMBLY OF AN ELECTRIC WATER HEATER

1. Before any work is done on the electric water heater, first:
   a. disconnect all power to the heater by opening the switch at the main electrical panel.
   b. connect power to test electric water heater.
   c. check for water leaks.
   d. shut off the water main.

2. The thermostat of the electric water heater can be changed by:
   a. using a center tap to adjust thermostat.
   b. using a screwdriver to move the thermostat pointer.
   c. change electrical connections.
   d. change elements.

3. Before servicing a switch on an electric water heater, first:
   a. trip with a screwdriver.
   b. heater must be disconnected from power supply.
   c. tap with a mallet.
   d. take a resistance check.

4. Before any electrical connections are made for an electric water heater, be sure that:
   a. the heater is empty of water so elements will not short out.
   b. the heater is full of water and that the valve in the cold water supply line is open.
   c. voltage is on.
   d. test equipment is functioning.

5. To determine the correct electrical hook-up and to obtain the most economical rates from an electric water heater, the serviceman should:
   a. see the manufacturers nameplate.
   b. consult the local power company in order to meet local utility and building codes.
   c. see instruction manual.
   d. see operation procedures.

6. To eliminate excessive fusing on an electric water heater, do which of the following?

   a. install a fused safety switch.
   b. install a pull switch.
   c. install a double pole switch.
   d. install a single pole switch.

7. What procedure should be followed to drain the electric water heater?

   a. turn power up to aid in draining the tank.
   b. turn up thermostat to pressurize tank.
   c. turn down thermostat to depressurize tank.
   d. shut off power supply, close cold water inlet valve, open a hot water faucet, and open the drain valve.

8. Where it is necessary or required by code to install a check valve in the cold water line for an electric water heater, what procedure should be followed?

   a. check valve must be installed between the tank.
   b. a pressure relief valve must be installed after the check valve.
   c. a pressure relief valve must be installed between the check valve and the heater.
   d. check valve must be installed after the tanks.

9. How should the insulation on an electric water heater be removed to allow access to the thermostat?

   a. with rubber gloves.
   b. fold the insulation outward away from the controls.
   c. with a hemostat.
   d. fold the insulation inward toward the controls.

10. Before repairing a thermostat on an electric water heater, first:

    a. remove the access panels or front panel on tabletop.
    b. drain water from tank.
    c. turn down the thermostat.
    d. turn up the thermostat.

LAP TEST ANSWER KEY: REPAIR, SERVICE AND REASSEMBLY OF AN ELECTRIC WATER HEATER

1. A
2. B
3. B
4. B
5. B
6. A
7. D
8. C
9. B
10. A

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File Code: 76.01.04.05 A2-0
Date Published: 8/15/75

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Operation of a Gas Water Heater

OBJECTIVES:

Describe the operation of a gas water heater.

Draw a schematic diagram of the thermocouple's electrical circuit.

EVALUATION PROCEDURE:

Student is to write a description about the operation of a gas heater that is consistent with the attached checklist.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Operation of a Gas Water Heater.
Gas water heater.
Home Appliance Servicing, Anderson.

PROCEDURE:

1. Read and study carefully the information found on pages 174-194 Home Appliance Servicing.

2. Operate the appliance and observe the characteristics of the appliance following the steps listed on the attached operational checklist.

3. Describe the operation of a gas water heater.

4. Complete the multiple-choice test items for this LAP.

5. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items.

Principal Author(s):

T. Ziller

If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

CHECKLIST: OPERATION OF A GAS WATER HEATER

______ 1. Check all water outlets, gaskets and valves.

______ 2. Connect to a water source and fill tank.

______ 3. Check pressure release valve for proper water level.

______ 4. Connect to a gas source using pressure regulators.

______ 5. Check for gas leaks. (Use a soap solution.)

______ 6. Turn gas controls to pilot and light pilot light.

NOTE: Read lighting instructions.

______ 7. Turn main valve control to "on" position.

NOTE: Main burner has ignited or should have.

______ 8. Adjust thermostat control to warm, then to hot setting. (Observe its effect on the main burner.)

______ 9. Turn gas control to off.

______ 10. Disconnect water and gas source.

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LAP TEST: OPERATION OF A GAS WATER HEATER

1. The gas-fired slow recovery water heater is designed to keep a constant supply of hot water in the storage tank by means of:

   a. instantaneous flame response.
   b. a constantly burning gas flame.
   c. storing it in a hot water supply tank.
   d. circulating the hot water through the pipes.

2. With a graduating-type thermostat employed in a gas-fired, slow-recovery water heater, the burner operates:

   a. between "off" and "on" flame gradually.
   b. between "off" and "on" flame instantaneously.
   c. between a low and high flame.
   d. a high flame only.

3. Why is the gas-fired low-recovery water heater advantageous where economy is the primary consideration?

   a. it uses hot water circulators to keep the water ready.
   b. the large amount of heating surfaces keep the standby loss low.
   c. it uses little gas circulators to keep the burner ready.
   d. the small amount of heating surfaces keeps the standby loss at a minimum.

4. Automatic instantaneous gas water heaters heat the water:

   a. when ever the thermostat reaches 200°.
   b. when ever the thermostat reaches 170°.
   c. directly on demand.
   d. automatically with a circulator control.

5. Gas burners on an instantaneous gas water heater are usually equipped with a gauge to:

   a. indicate amount of gas being used.
   b. override switches.
   c. protect the flame from backflash.
   d. indicate amount of water being heated.

6. The function of the pilot in a gas water heater is to:

   a. move the gas to the burner.
   b. start the water flow in the tank.
   c. ignite the burner and to heat the thermocouple.
   d. control the flow of gas to the burner.

7. What is the function of the thermocouple in a gas water heater?

   a. to couple the gas to the burner.
   b. to couple the temperature to the water.
   c. to supply gas to the burner.
   d. to supply a low-voltage electrical current to the magnet in a safety switch, valve, or thermostat.

8. When the thermostat button or dial is actuated, on an automatic gas water heater, the magnet (located inside the thermostat) is:

   a. bent back to catch the safety latch.
   b. pushed forward and engages a safety catch.
   c. opened in order to switch the circuit.
   d. closed in order to switch the circuit.

9. The activated spring-loaded safety catch on an automatic gas water heater snaps back into position if:

   a. the switching mechanism is shorted.
   b. the opened switch is deactivated.
   c. the pilot-thermocouple combination does not produce enough current to create the necessary magnetic holding power.
   d. the amperage is above two AMPS.

10. What device on an automatic gas water heater is used to relieve excessive pressure in the heating system?

    a. pressure-relief valve.
    b. shut-off valve.
    c. gas regulator.
    d. thermocouple.

LAP TEST ANSWER KEY: OPERATION OF A GAS WATER HEATER

1. B
2. C
3. D
4. C
5. C
6. C
7. D
8. B
9. C
10. A

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Disassembly of a Gas Water Heater

OBJECTIVES:

Disassemble and identify the parts of a gas water heater.

EVALUATION PROCEDURE:

Instructor will examine the disassembled appliance for correct disassembly and parts identification in accordance with the attached checklist.

Score at least 80% on the multiple-choice test.

RESOURCES:

Checklist: Disassembly of Gas Water Heater.
Tools and gas water heater.
Service Manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Disassembly of a Gas Water Heater.
2. Complete the multiple-choice test items for this LAP.
3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): T. Ziller

CHECKLIST: DISASSEMBLY OF A GAS WATER HEATER

_____ 1. Turn off gas supply and uncouple gas line at heater.

_____ 2. Turn off water supply.

_____ 3. Drain heater and disconnect from water source.

_____ 4. Remove front panel and burner assembly.

_____ 5. Remove pilot-thermocouple from burner assembly.

_____ 6. Disconnect flue pipe.

_____ 7. Identify each part by labeling it.

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LAP TEST: DISASSEMBLY OF A GAS WATER HEATER

1. When disassembling a gas water heater the first step is to:

   a. open hot water faucet to allow air to enter system.
   b. turn off water supply.
   c. close the cold water inlet valve.
   d. shut off gas supply and uncouple gas line at heater.

2. When disassembling the gas water heater in (Fig. 6) locate the air shutter.

   a. 14
   b. 6
   c. 11
   d. 7

3. During disassembling the gas water heater (Fig. 6), the point of circulation would be:

   a. 10
   b. 11
   c. 8
   d. 12

4. In the disassembly view of a gas water heater (Fig. 6) locate the drafthood.

   a. 6
   b. 13
   c. 7
   d. 14

5. In the disassembly view of a gas water heater (Fig. 6) number 14 indicates the location of:

   a. flue.
   b. circulation pipe.
   c. pipe to chimney.
   d. drawoff.

6. In the disassembly view of a gas water heater (Fig. 6) locate the bunsen burner.

   a. 10
   b. 7
   c. 11
   d. 8

7. Locate the hot water outlet in (Fig. 6) of a gas water heater.

   a. 4
   b. 2
   c. 5
   d. 1

8. Locate the cold water inlet in (Fig. 6) of a gas water heater.

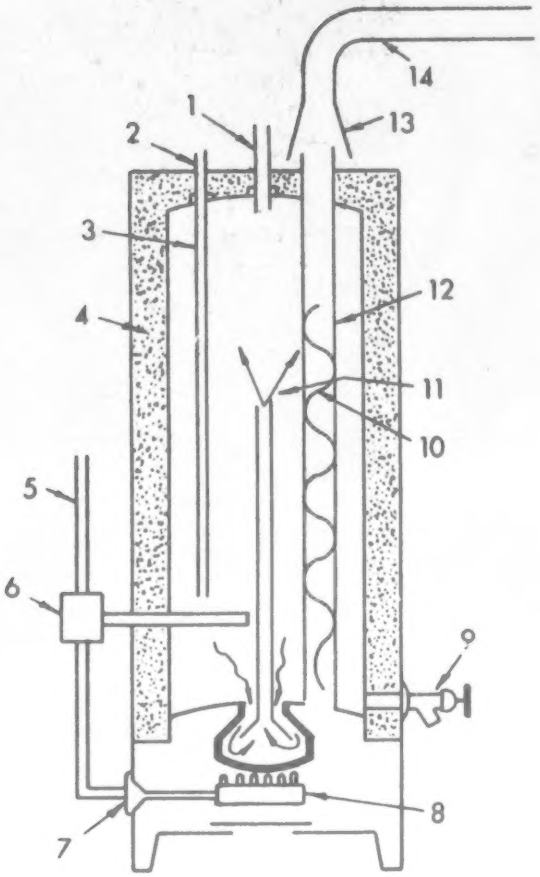
   a. 9
   b. 1
   c. 5
   d. 2

9. In (Fig. 6) of a gas water heater locate the insulation.

   a. 11
   b. 10
   c. 4
   d. 12

10. In the disassembling the gas water heater (Fig. 6) the thermostat would be located where?

   a. 8
   b. 7
   c. 6
   d. 4



AUTOMATIC GAS WATER HEATER
STORAGE TYPE

Figure 6

LAP TEST ANSWER KEY: DISASSEMBLY OF A GAS WATER HEATER

1. D
2. D
3. B
4. B
5. C
6. D
7. D
8. D
9. C
10. C

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Learning Activity Package

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Diagnosis of Malfunctions in a Gas Water Heater

OBJECTIVE:

Diagnose malfunctions in a gas water heater using appropriate tools and procedures.

EVALUATION PROCEDURE:

Electrical values found during diagnosis are consistent with specifications found on the manufacturer's name plate.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Diagnosing Malfunctions - Gas Water Heater
Tools, test equipment, work order form and gas water heater.
Service manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist; Diagnosis of Malfunctions - Gas Water Heater.
2. Complete the multiple-choice test items for this LAP.
3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): T. Ziller

CHECKLIST: DIAGNOSIS OF MALFUNCTIONS - GAS WATER HEATER

______ 1. Complete and attach a work order form.

NOTE: Extinguish all smoking materials in the immediate area.

______ 2. Make a visual inspection.

______ 3. Check manuafacturer's specifications for gas P.S.I.

______ 4. Check manufacturer's specifications for orifice type. (LP/NAT)

______ 5. Measure relay resistance: ______.

______ 6. Connect to gas source and light pilot.

______ 7. Check pilot for proper height.

______ 8. Set thermostat for burner ignition.

______ 9. Check burner for proper flame head.

______ 10. Adjust air shutter for proper flame characteristics.

______ 11. Check thermocouple for proper operation. (Millivolt meter).
Voltage: ______

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LAP TEST: DIAGNOSIS OF MALFUNCTIONS IN A GAS WATER HEATER

1. If there is insufficient hot water, check what part on the gas water heater?

   a. thermocoupler's circuit control.
   b. thermoswitch controls.
   c. temperature setting(s) of the thermostat.
   d. thermostats contact points.

2. If the gas water heater tank temperature is satisfactory but the water arriving at the faucet has lost too much heat, check:

   a. thermostat.
   b. gas pressure.
   c. water pressure.
   d. run of pipe, or insulation.

3. What condition can a down draft from the chimney cause if a down draft diverter is not installed?

   a. burner flare up and cause smoke.
   b. pilot flame extinguished, no hot water.
   c. burner burn too fast and cause excess heat.
   d. pilot flame flare up and cause premature ignition.

4. If the gas water heater bills are too high, check:

   a. improper selection of a heater for the hot water requirements of the house.
   b. the burner for leakage.
   c. the pilot flame adjustment.
   d. improper gas pressure.

5. If the gas water heater water temperature exceeds 140°F, check:

   a. thermocouple current.
   b. thermostat setting(s)
   c. pilot flame adjustment.
   d. burner flame adjustment.

6. If there is considerable loss of hot water from the gas water heater over a long period of time, check:

   a. leaking hot water faucets.
   b. insulation.
   c. run of pipe.
   d. water pressure.

7. If the gas water heater is overheating, check:

   a. pilot flame adjustment.
   b. thermocouple.
   c. thermostat.
   d. burner flame adjustment.

8. If there is improper burning of the gas on a gas water heater, check:

   a. gas leak.
   b. burner flame adjustment.
   c. gas pressure.
   d. air shutter.

9. If there is a soot formation of the gas water heater, check:

   a. air shutter.
   b. flue.
   c. gas pressure.
   d. for dirty orifice.

10. If there is noisy operation of the gas water heater and sediment in the water lines, check:

    a. relief valve.
    b. water source.
    c. back pressure valve.
    d. drain.

LAP TEST ANSWER KEY: DIAGNOSIS OF MALFUNCTIONS IN A GAS WATER HEATER

1. C
2. D
3. B
4. A
5. B
6. A
7. C
8. D
9. A
10. D

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File Code: 76.01.04.08.A2-0
Date Published: 8/15/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Repair, Service and Reassembly of a Gas Water Heater

OBJECTIVES:

Order replacement parts for the gas water heater.

Repair, service, and reassemble a gas water heater.

EVALUATION PROCEDURE:

The appliance must operate properly.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Repair, Service and Reassembly - Gas Water Heater.
Test equipment, tools, appliance parts catalog and requisition form.
Gas water heater.
Service manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Repair, Service and Reassembly - Gas Water Heater.

2. Complete the multiple-choice test items for this LAP.

3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): T. Ziller

CHECKLIST: REPAIR, SERVICE AND REASSEMBLY - GAS WATER HEATER

Repair and Service:

_____ 1. If any coupling device leaks, replace and/or seal it.

_____ 2. If orifice is dirty, clean with solvent.

_____ 3. If air shutter is misadjusted, reset.

_____ 4. If flash tube is misaligned, realign.

_____ 5. If pilot is high/low, readjust.

_____ 6. If thermocouple is inoperative, replace with same type.

_____ 7. If gas valve relay is open or shorted, replace with same type.

Reassemble:

_____ 1. Replace element seals and element.

_____ 2. Replace thermostat and thermostat mounting clip, then tighten mounting bolts.

_____ 3. Replace conductors (use the wiring diagram).

_____ 4. Replace access panels and tighten mounting screws.

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LAP TEST: REPAIR, SERVICE AND REASSEMBLY OF A GAS WATER HEATER

1. What should be avoided when installing the pressure-relief valve on the gas water heater?

   a. install shutoff above the burner.
   b. do not install a shutoff valve between pressure-relief valve and the heater.
   c. install pressure relief above the burner.
   d. do not install a shutoff valve.

2. If the gas water heater pilot light continues to be extinguished after relighting, correct the situation by:

   a. cleaning the pilot filter, the pilot orifice and the gas tube.
   b. turning up the gas pressure.
   c. preheating the pilot before lighting.
   d. shielding the flame before lighting.

3. If there is no hot water in a gas water heater, a possible solution would be to:

   a. adjust the thermocouple.
   b. adjust burner for proper adjustment.
   c. make correct pilot flame adjustment.
   d. set the thermostat up.

4. If the water from the instantaneous water heater is not hot enough when the gas consumption is adjusted to the manufacturer's rating, and the thermostatic control is correctly set, what procedure should be followed?

   a. the cold water regulating valve at the heater should be throttled until the water stays hot under a continuous flow.
   b. the cold water should be shut off until the hot water reaches the proper temperature.
   c. the burner flame should be turned up to compensate for the temperature fluctuation.
   d. the thermocouple should be replaced.

5. The proper air-gas mixture on a gas water heater is obtained by:

   a. controlling the input temperature setting.
   b. adjusting the gas pressure on the main valve.
   c. changing the orifice setting.
   d. adjusting the air shutter on the mixer face of the main burner.

6. For proper burning of gas on a gas water heater, adjust by:

   a. loosening the air shutter nut, rotating shutter to close the opening in the burner, then slowly rotating the shutter until the yellow tips disappear.
   b. turning the main valve counterclockwise until flame height is 3/16".
   c. controlling the gas metering valve with a set screw.
   d. rotating the thermopiles elements until they turn red.

7. What is the procedure for completely draining the gas water heater?

   a. hook up a garden hose to faucet and attach to floor drain.
   b. open up the relief faucet on the side of the water heater.
   c. disconnect water heater tank from water source and turn on drain plug.
   d. shut off gas supply, close the cold water inlet valve, open a hot water faucet and open the drain valve.

8. If the gas water heater is installed in an enclosed area, what must be provided?

   a. three ventilation openings.
   b. one ventilation opening.
   c. two ventilation openings.
   d. four ventilation openings.

9. What is the installation procedure for location of a gas water heater?

   a. location accessible to water and gas supply lines near the chimney where the floor is level.
   b. near a drain for draining purposes.
   c. near a window for ventilation purposes.
   d. near an electrical source for safety purposes.

10. What is the installation procedure for connecting the draft diverter to the chimney flue pipe for a gas water heater?

   a. the chimney flue pipe should be the same diameter as the outlet of the diverter and using the least number of vent pipe elbows possible.
   b. chimeny diameter should be larger than outlet of the heater for vent purposes.
   c. the director should be smaller than the heater vent outlet.
   d. draft director should not exceed 1' in length for proper connection and safety.

LAP TEST ANSWER KEY: REPAIR, SERVICE AND REASSEMBLY OF A GAS WATER HEATER

1. B
2. A
3. C
4. A
5. D
6. A
7. D
8. C
9. A
10. A

Student: ____________________ File Code: 76.01.04.00.B2-2

Date: ____________________ Date Published: 11/11/75

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UNIT POST TEST: **WATER HEATERS**

76.01.04.01

1. In an electric water heater, which heating element has a higher wattage rating?

    a. upper.
    b. lower.
    c. intermediate.
    d. upper and lower.

2. Name the type of service offered by power companies in which current is available to a single- or double-unit electric water heater 24 hrs. a day.

    a. limited-variable demand.
    b. limited demand.
    c. nonlimited-demand.
    d. variable demand.

3. When an electric water heater refills with water, water is fed in the heating tank at which of the following points?

    a. top only.
    b. bottom only.
    c. simultaneously top/bottom.
    d. middle only.

4. The electric water heater tank is filled with cool water and a double-throw thermostat completes the circuit to the upper element causing which of the following to happen?

    a. opens the upper element.
    b. connects the lower element.
    c. disconnects the lower element.
    d. shorts the lower element.

5. When the water in the upper part of the electric water heater tank is heated, which thermostat switch disconnects the upper element and connects the lower element to heat the remainder of the water in the tank?

    a. double-throw thermostat.
    b. single-throw thermostat.
    c. single pole double-throw thermostat.
    d. double pole single-throw thermostat.

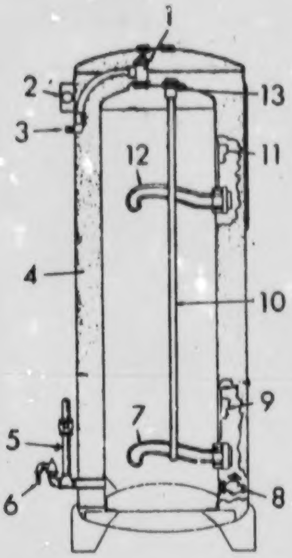


Figure 4

The principal components of a round-shell electric water heater.

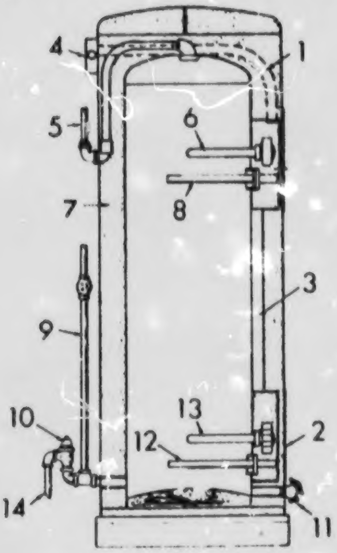


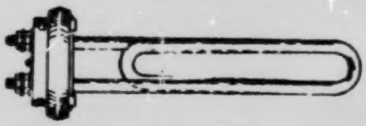
Figure 5

Construction features of a typical round-shell electric water heater.

76.01.04.02

6. Name the heating unit illustrated which may be employed in electric water heaters:

   a. life belt.
   b. sickle.
   c. tubular.
   d. loop stick.



Illus. 1

7. The diaphragm relief value drain is represented by which number on (Fig. 4), an electric water heater?

   a. 14
   b. 6
   c. 8
   d. 9

8. In the illustration of an electric water heater (Fig. 4), locate by number the location of the tank valve drain.

   a. 3
   b. 6
   c. 8
   d. 1

9. In the illustration of an electric heater (Fig. 4), locate by number the tee connection.

   a. 1
   b. 13
   c. 12
   d. 3

10. In the illustration (Fig. 5) of an electric heater locate by number the wiring conduit.

    a. 6
    b. 3
    c. 4
    d. 1

76.01.04.03

11. If the water is too hot in an electric water heater, what is the possible cause?

    a. double-throw thermostat sticking in the closed position.
    b. single-throw thermostat sticking in the closed position.
    c. double-throw thermostat sticking in the open position.
    d. single-throw thermostat sticking in the open position.

76.01.04.03 (continued)

12. Many of the cases for high water bill complaints can be traced to the water heater being:

    a. thermostat setting is too low.
    b. limited demand electrical hook-up.
    c. full service demand electrical hook-up.
    d. setting improperly temperatures for the hot water requirements of the house.

13. If the heating elements on an electric water heater are not completely immersed in water at all times, what condition will this cause?

    a. partial failure of heating elements.
    b. partial heating effect.
    c. complete heating effect.
    d. complete failure of heating elements.

14. The manual reset, trip-free temperature limiting devices on a particular electric water heater will cut off all power to heater if:

    a. temperature of water exceeds 150°F.
    b. temperature of water exceeds 190°F.
    c. temperature of water exceeds 300°F.
    d. temperature of water exceeds 212°F.

15. If there is not hot water coming from an electric water heater after a reasonable amount of time, what is the possible cause?

    a. thermostat contact points are shorted.
    b. pilot light is out.
    c. a fuse may be blown.
    d. thermostat contact points are open.

76.01.04.04

16. If there is not hot water coming from the electric water heater after a reasonable period of time:

    a. check copper tubing for bends.
    b. check water leaks.
    c. check insulation.
    d. check the entire circuit, including the elements and thermostats before resetting the temperature limiting device.

17. What should be the first procedure before making electrical connections on electric water heater?

    a. take a resistance check.
    b. see service manual.
    c. check rating plate and the wire diagram.
    d. take a continuity check.

76.01.04.04 (continued)

18. When replacing the insulation over the controls after thermostat adjustment on an electric water heater, check:

    a. snugness of thermostat contact points.
    b. screw adjustments for tightness.
    c. that controls are well covered and that the plastic terminal shield has not been displaced.
    d. switching mechanism for timing.

19. What procedure should be followed to check the temperature-pressure relief valve on an electric water heater?

    a. raise the test lever at the top of this valve to make certain that water ways are clear.
    b. shake the tank to check its ballast.
    c. turn on the hot water faucet.
    d. turn on the cold water faucet.

20. If the water heater is noisy during operation, follow what procedure for correction?

    a. turn up thermostat to pressurize the tank.
    b. shut power off.
    c. drain the heater through the drain valve until water runs clear.
    d. turn down thermostat to depressurize the tank.

76.01.04.05

21. The manual gas water heater can supply hot water by:

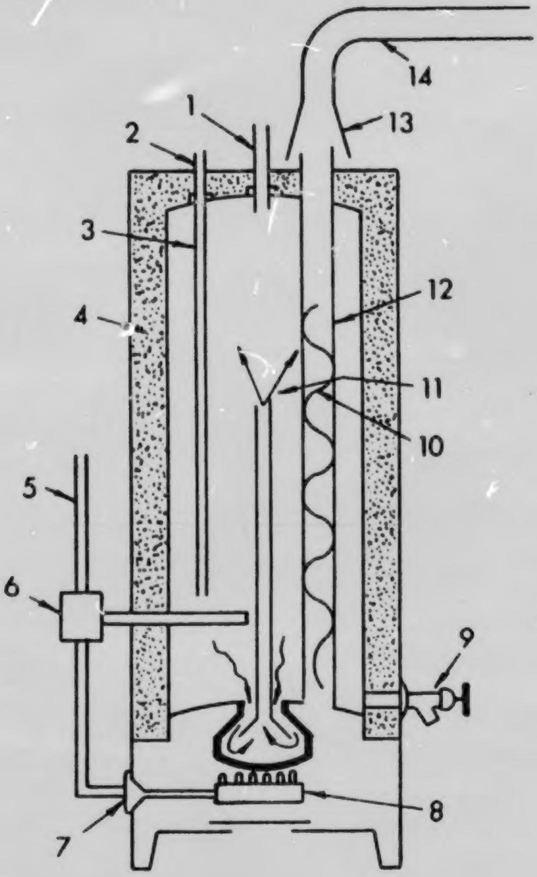
    a. circulating the hot water through the pipes.
    b. storing it in a hot water supply tank.
    c. keeping the hot water pipes hot.
    d. igniting the gas shortly before the warm water is required.

22. The throttling-type thermostat on a quick-recovery water heater is one in which the amount of gas-valve opening is:

    a. indirectly proportional to the temperature changes of the water in the tank.
    b. a device that idles back like a carborator.
    c. a device that uses a mechanical linkage to control the thermostat.
    d. directly proportional to the temperature changes of the water in the tank.

23. What actuates the gas flame on an instantaneous gas water heater whenever water is drawn from the faucet?

    a. flow motors or water valves.
    b. a thermostat switching device.
    c. a circulator solenoid.
    d. flow valves or water motors.



AUTOMATIC GAS WATER HEATER
STORAGE TYPE

Figure 6

76.01.04.05 (continued)

24. For the snap-action thermostat to operate properly, the valve gap must be a adjusted so that:

    a. the contacts open and close.
    b. the valve does not open or close while the clicker is being moved by the Invard rod.
    c. the valve opens only when the thermostat closes.
    d. the valve closes only when the thermostat opens.

25. If pressure is applied to the main valve on an automatic gas water heater, what happens to the valve?

    a. closes and stops the flow of gas to the main burner.
    b. opens and closes, allowing gas to flow to the main burner.
    c. causes the thermocouple to engage.
    d. shorts the thermostats contacts.

76.01.04.06

26. When disassembling the gas water heater in (Fig. 6) locate the gas pipe:

    a. 5
    b. 1
    c. 2
    d. 9

27. In disassembling the gas water heater (Fig 6) locate the drawoff.

    a. 5
    b. 13
    c. 9
    d. 2

28. In the disassembly view of a gas water heater (Fig. 6) number 10 indicates the location of:

    a. flue.
    b. heat retarder.
    c. pipe to chimney.
    d. drawoff.

29. Locate the hot water outlet in (Fig. 6) of a gas water heater.

    a. 4
    b. 2
    c. 5
    d. 1

76.01.04.06 (continued)

30. Locate the flue in (Fig. 6) of a gas water heater.

    a. 13
    b. 14
    c. 11
    d. 12

76.01.04.07

31. If there is insufficient hot water, check what part of the gas water heater?

    a. thermocoupler's circuit control.
    b. thermoswitch controls.
    c. temperature setting(s) of the thermostat.
    d. thermostat contact points.

32. If the gas water heater tank has no hot water, check:

    a. thermocoupler's current flow.
    b. gas pressure.
    c. water pressure.
    d. pilot flame.

33. If the gas water heater water is too hot, check:

    a. pilot flame adjustment.
    b. thermostat adjustment.
    c. burner flame adjustment.
    d. thermocoupler.

34. If an electric water heater double-pole, double-throw thermostat is sticking in the closed position, what is the result?

    a. water too hot.
    b. water too cold.
    c. water warm.
    d. no water.

35. What is an easy way to check the gas water heater water temperature?

    a. checking the current in the thermocoupler.
    b. checking the thermostat setting.
    c. holding a thermometer under an open hot water faucet.
    d. using a thermometer against the water pipe.

76.01.04.08

36. If there is a leak in the gas water heater gas or water pipes, what procedure should be followed?

    a. replace defective pipes.
    b. solder bad section.
    c. use flux to plug the leak.
    d. cover pipe with adhesive.

37. The solution to the problem of insufficient hot water in a gas water heater is:

    a. turning up the flame.
    b. increasing the temperature setting(s) of the thermostat(s).
    c. increasing the thermocoupler's current.
    d. replacing the thermostat.

38. If heat deficiency is caused by a too extensive run of pipe, this condition can be corrected by:

    a. installing another water heater in series.
    b. installing a circulator motor.
    c. relocating or insulating the exposed hot water pipes.
    d. relocating the water heater.

39. In a properly adjusted gas water heater burner, the flame should:

    a. not reach higher than the bottom of the third coil when the proper BTU input is supplied.
    b. not overlap the secondary flame.
    c. not flash or flare up when ignited.
    d. not be set too high and cause improper thermostat settings.

40. What is the installation procedure for a gas water heater?

    a. not exceed 15 feet in length and should not project into the chimney beyond the inner wall.
    b. it should not exceed 2 feet and should not project beyond the inner wall.
    c. it should not exceed 8 feet and should project beyond the inner wall of the chimney.
    d. it should extend beyond the inner wall of the chimney and should not exceed 10 feet in length.

UNIT TEST ANSWER SHEET
POST TEST

Occupational Area: ______________________

File Code: 76.01.04.00.B2-2

Name: ______________________

ANSWERS

76.01.04.01	1.	A	76.01.04.05	21.	D	41.	
	2.	C		22.	D	42.	
	3.	B		23.	D	43.	
	4.	C		24.	B	44.	
	5.	A		25.	A	45.	
76.01.04.02	6.	A	76.01.04.06	26.	A	46.	
	7.	B		27.	C	47.	
	8.	C		28.	B	48.	
	9.	A		29.	D	49.	
	10.	D		30.	D	50.	
76.01.04.03	11.	A	76.01.04.07	31.	C	51.	
	12.	D		32.	D	52.	
	13.	D		33.	B	53.	
	14.	B		34.	A	54.	
	15.	C		35.	C	55.	
76.01.04.04	16.	D	76.01.04.08	36.	A	56.	
	17.	C		37.	B	57.	
	18.	C		38.	C	58.	
	19.	A		39.	A	59.	
	20.	C		40.	A	60.	

Student: ____________________ File Code: 76.01.04.00.A1-5

Date: ____________________ Date Published: 11/12/74

Mountain-Plains Education &
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Program, Inc.
Glasgow AFB, Montana 59231

Family Pay Number: __________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: WATER HEATERS

OBJECTIVE 1:

Given a malfunctioning water heater, the student will service and repair the water heater so that it functions according to the manufacturer's specifications, following safe practices and procedures.

OBJECTIVE 2:

Using appropriate tools and test equipment, the student will calculate and record amperage, voltage, resistance, and wattage of a water heater's electrical system.

OBJECTIVE 3:

Given a gas water heater the student will connect it to a gas source using appropriate tools.

OBJECTIVE 4;

The student will light and adjust pilot light.

OBJECTIVE 5:

Using appropriate tools the student will adjust burner's air shutter for proper gas/air mixture.

TASK:

The student will service and repair a malfunctioning gas water heater and, in the process, he will take and record amerage, voltage, resistance, and wattage readings of the electrical circuits for both using appropriate test equipment. He will light and adjust the pilot light and adjust the gas/air mixture for the water heater burner on the gas water heater only.

ASSIGNMENT:

CONDITIONS:

The student will be given a malfunctioning water heater (it may be bugged by the instructor or it may be one brought in by a customer). He will be required to service and repair the water heater in conditions similar to those in a typical appliance repair shop. He will be allowed to use any and all tools, equipment, service manuals, text books, etc., commonly found in a repair shop. He must complete it in a reasonable length of time with no assistance from the instructor(s) or students.

RESOURCES:

Tools:

Amprobe RS-3 Rotary Meter (B-A)
Soldering gun 100 to 140 watt
Adjustable Wrench
Nut Driver Set
Long Nose Pliers
Diagonal Cutters
Slip Joint Pliers
Screwdriver Set
Phillips Set
Hex & Spline Wrench Kit
Vise Grip Plier Model Size 7"
Utica Electrician's Knife, Standard Size
18" Aluminum Level
12' Steel Tape
Punch & Chisel Set, 1/2", 5/8" chisels; 3/16, 3/8, 5/32 punches
Combination Wrench Set
Hammer (Ball Peen) 12 oz.
10" Channel-lock Plier
Utility Box
VOM
Assortment of wire, fasteners and repair parts
Water heater

Printed Material:

Various Repair Manuals
Manufacturer's Specification Sheets

Student: ______________________ File Code: 76.01.04.00.A1-5

Date: ______________________ Date Published: 11/12/74

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Family Pay Number: __________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Follows safe practices and procedures.		
Criterion: No injury results to the student or the equipment and		
complies with OSHA requirements.		
2. Follows proper procedures for disassembly.		
Criterion: No damage results to the appliance.		
3. Diagnosis and troubleshoots malfunctions properly.		
Criterion: When repaired, the appliance functions according to the		
manufacturer's specifications.		
4. Reassembles the appliance properly.		
Criterion: Appliance functions according to the manufacturer's		
specifications and the procedures followed agree with those		
described in the service literature.		
5. The repaired appliance is repaired in a neat,		
professional manner.		

(Checklist continued)

	CRITERION	
	Met	Not Met
Criterion: No damage results to the appliance such as scratches and dents.		
6. All connections and fastening are properly completed.		
Criterion: The appliance connection complies with the manufacturer's specifications. The connection is mechanically fastened and structurally sound. The connection is electrically fastened and free of defects.		
7. Appliance functions according to the manufacturer's specifications.		
Criterion: Manufacturer's specifications.		
8. Uses appropriate repair part and supplies.		
Criterion: They match exactly those listed in the manufacturer's specifications.		
Objective 2:		
9. Uses test equipment properly.		
Criterion: Manufacturer's specifications.		
10. Wattage readings are accurate.		
Criterion: Manufacturer's Specifications		
11. Voltage readings are accurate.		
Criterion: Manufacturer's Specifications.		

(Checklist continued)

	CRITERION	
	Met	Not Met
12. Amperage readings are accurate.		
Criterion: Manufacturer's Specifications.		
13. Resistance readings are accurate.		
Criterion: Manufacturer's specifications.		
14. When applicable mathematical calculations are correct.		
Criterion: AC/DC Circuit Manuals, Westinghouse.		
Objective 3:		
15. Student uses proper size wrench.		
Criterion: Fits the fittings size snuggly.		
16. Student uses soap to check for leaks.		
Criterion: Avoids an explosion when match is struck or cigarette is in the area.		
Objective 4:		
17. Student lights the pilots using a match or lighter.		
18. Student adjusts the pilot adjustment screw for proper height (3/16").		
Criterion: Pilot burns without going out.		
Objective 5:		
19. The student adjusts air shutter to form a flame character of a solid blue flame.		

(Checklist continued)

	CRITERION Met	Not Met
20. The student adjusts flame height at maximum control.		
Criterion: The flame burns clean and free of soot.		
21. The appliance is repaired in a reasonable amount of time.		
Criterion: Not to exceed 2 hours.		
The student must complete 18 out of 21 line items to achieve an overall score of satisfactory.		

File Code: 76.01.05.00.A2-1

Date Published: 8/18/75

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Learning Experience Guide

UNIT: ELECTRIC RANGES

RATIONALE:

Every appliance serviceman is expected to service and repair various types of electric ranges. To be an effective serviceman, he must understand how a particular appliance works.

PREREQUISITES:

76.01.04 Unit: Water Heaters

76.01.07 Unit: Series Parallel Circuits

OBJECTIVES:

Operate; disassemble; diagnose malfunctions; repair, replace or service component parts; and reassemble an electric range according to manufacturer's specification using appropriate service manuals, equipment and tools, and following safe practices.

Identify characteristics of operation, components, and diagnostic repair and service procedures for electric ranges.

RESOURCES:

Printed Materials

Appliance Service Manuals for appliances used in the program.
Catalogs, appliance supply (assortment).
Home Appliance Servicing. Edwin P. Anderson, 2nd Edition, Theordore Audel and Company, Indianapolis, Indiana, 1965.
Order forms.
Work order forms.
Manufacturer's specification sheets.

Equipment

Test equipment: Amprobe (RS-3 Rotary Meter B-A). Meter, volt-ohm.

Principal Author(s): T. Ziller

Tools:

Box, utility.
Chisels, (½" and 5/8").
Cutters, diagonal.
Gun, soldering (100-140 watt).
Hammer, ball pein (12 oz.).
Kit, solderless terminal.
Knife, electricians.
Level, aluminum 18".
Nut driver set.
Pliers, channel-lock (10").
Plier, long nose.
Plier, slip joint.
Plier, vise grip (size 7").
Puncher (3/16", 3/8" & 5/32").
Screwdriver, blade (set).
Screwdriver, Phillips (set).
Tape, steel measuring (12 ft.).
Wrench, adjustable.
Wrench, combination set.
Wrench, hex & spline (kit).

GENERAL INSTRUCTIONS:

This unit consists of four Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) Take the unit tests as describe in the Unit LEG "Evaluation Procedures".
(9) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Operation of an Electric Range
.02 Disassembly of an Electric Range
.03 Diagnosis of Malfunctions in an Electric Range
.04 Repair, Service and Reassembly of an Electric Range

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

After reading this unit guide, obtain the LAP for the first assigned performance activity.

Student: ______________________ File Code: 76.01.05.00.A2-2

Date: ______________________ Date Published: 11/18/74

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UNIT PRETEST: ELECTRIC RANGES

76.01.05.01

1. In a 2-unit electric range oven, which switch arrangement in Illustration 2 represents broil?

   a. 4
   b. 1
   c. 2
   d. 5

2. In a 2-unit electric range oven, number 4 in Illustration 2 represents the heat value for which of the below?

   a. off.
   b. broil.
   c. bake 2.
   d. preheat.

3. Switch position No. 1 in Illustration 3 represents what heat temperature for a surface heating element on an electric range?

   a. high heat.
   b. medium heat.
   c. low heat.
   d. simmer.

4. Heat variations on an electric range are usually obtained by:

   a. changing the current flow in the series connected elements.
   b. changing the thermostat variation by changing the control knob.
   c. connecting parallel heat units to form a heating pair.
   d. connecting two or more elements in series or parallel and/or by varying the voltage supplied to the elements.

5. What is the determing factor as to what type of current the electric range can be operated on?

   a. the type of controls, namely the switches, thermostat, and timing devices.
   b. heating element design.
   c. cost per element unit.
   d. cost per electric range.

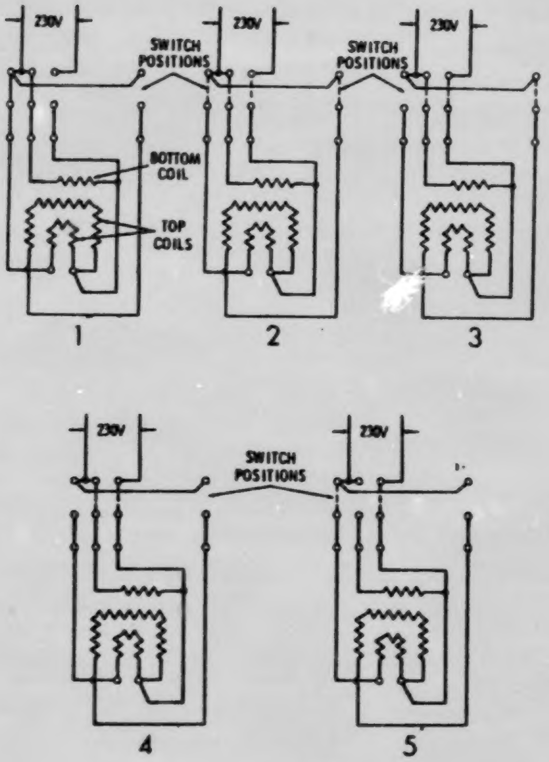


Illustration 2

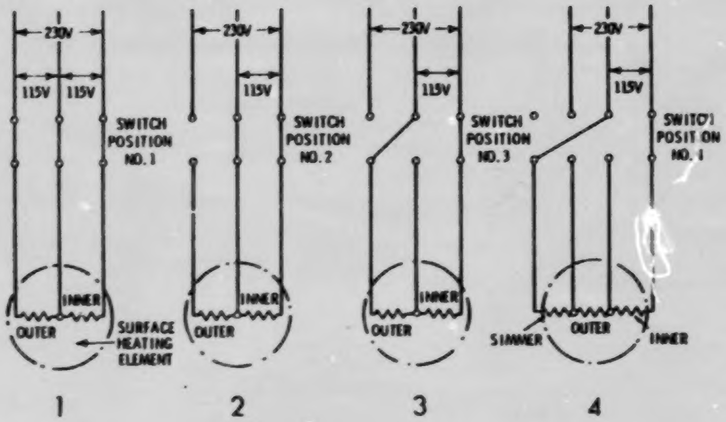
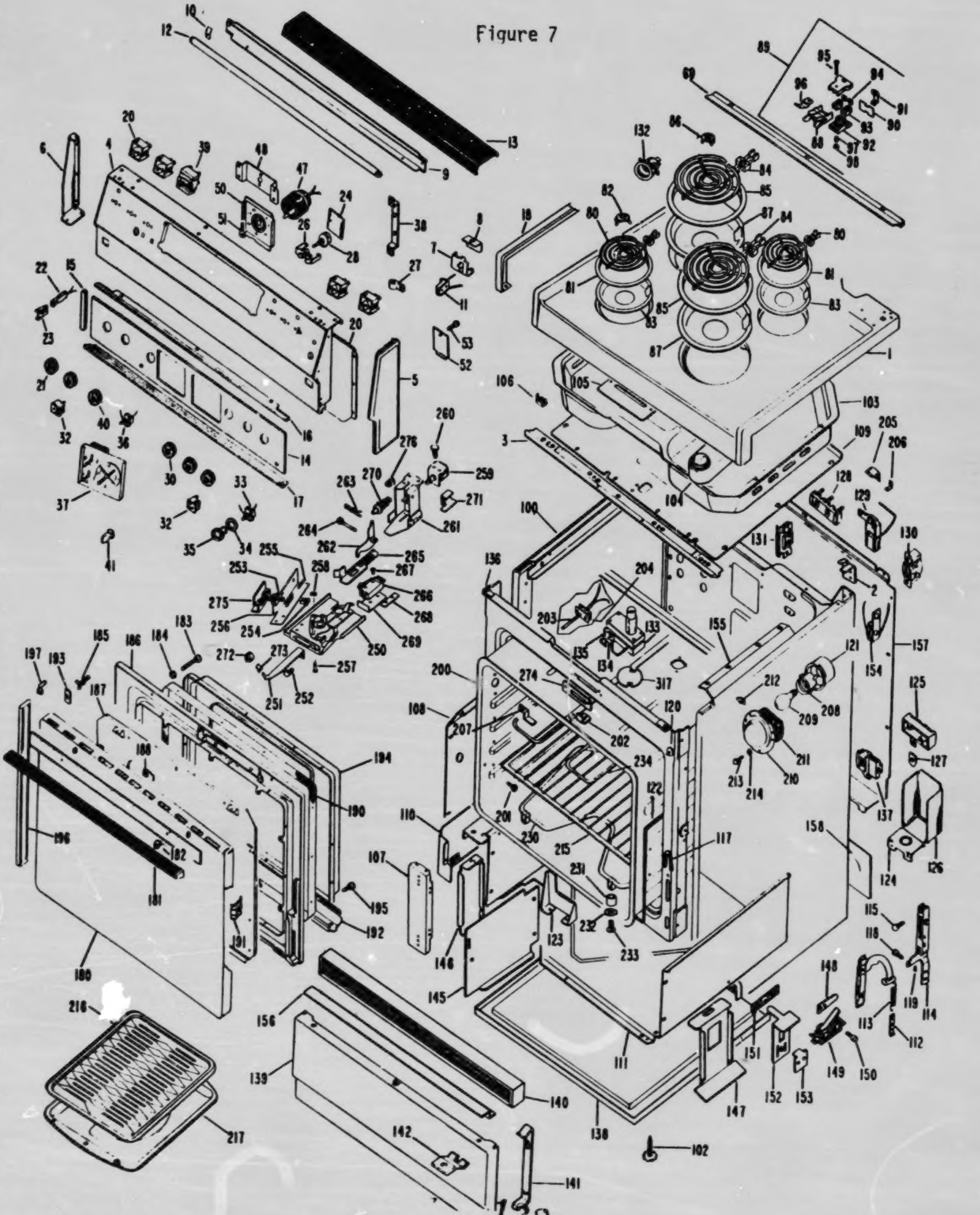


Illustration 3

Figure 7



76.01.05.02

6. Identify by number (Fig. 7) the unit pan-6" on an electric range.

   a. 83
   b. 80
   c. 82
   d. 81

7. Identify by number (Fig. 7) the ballast on an electric range.

   a. 130
   b. 128
   c. 129
   d. 131

8. Identify by number (Fig. 7) the actuator-switch on an electric range.

   a. 266
   b. 255
   c. 250
   d. 254

9. Identify by number (Fig. 7) the switch P-7 rotary on an electric range.

   a. 47
   b. 20
   c. 28
   d. 39

10. Identify by number (Fig. 7) the oven light switch on an electric range.

   a. 120
   b. 154
   c. 131
   d. 135

76.01.05.03

11. When checking difficulties on inoperative fluorescent lamps on an electric range, first:

   a. turn off the fluorescent switch.
   b. check the ballast for the proper setting.
   c. adjust the transformer for proper voltage.
   d. inspect the terminals on the line terminal block to check if proper current is available.

76.01.05.03 (continued)

12. If after replacing both the bulb and the starter the fluorescent lamp on an electric range still fails to operate, the problem is:

    a. in the transformer's core.
    b. in the ballast or the wiring.
    c. in the single-pole double-throw switch.
    d. in the fluorescent bulb filaments.

13. What condition exists if an electric range is drying or burning causing excess temperatures?

    a. the thermostat is miscalibrated.
    b. the thermostat is too high.
    c. the voltage is too high.
    d. the current is too high.

14. If after the electric range oven is heated the oven door opens at the top allowing heated air to escape and cool air to enter, what may be the cause?

    a. the insulation has shrunk.
    b. the frame is twisted.
    c. the oven door is too small.
    d. the oven door has improper clearance at the bottom.

15. Adjusting the heat controls on an electric range without first analyzing the source of the trouble may result in:

    a. over current fluctuations.
    b. improper adjustment of controls.
    c. voltage surges.
    d. improper power consumption.

76.01.05.04

16. When replacing the thermal switch, be sure the thermostat capillary is:

    a. in series with the thermostat.
    b. thermally tight.
    c. dressed away from the thermal switch's electrical contacts.
    d. in parallel with the thermostat.

17. When replacing an oven sensor, it is recommended that the connection of the new sensor be:

    a. soldered before the ceramic connectors are installed.
    b. stripped of insulation before installed.
    c. pressurized before installed.
    d. wired before electrical connections are installed.

76.01.05.04 (continued)

18. What procedure is followed when repairing a bent latch lever on an electric range?

    a. after removing the latch lever halfway, the lever can then be bent to its normal position.
    b. after removing the bent lever replace with new lever.
    c. bend with screw driver after cutting power.
    d. after removing adjust set-screw.

19. When replacing a burned out solenoid in an electric range, replace the:

    a. ballast and transformer before the new solenoid.
    b. solenoid before rewinding.
    d. plunger before rewinding.
    d. solenoid coil and plunger to insure proper operation.

20. Calibration of the oven responder, on an electric range, for bake temperature must be made on the:

    a. knob or dial only.
    b. small adjusting screw inside the oven responder.
    c. outside responder control knob.
    d. in the oven timer.

UNIT TEST ANSWER SHEET

PRETEST

Occupational Area: ______
File Code: 76.01.05.00.A2-2
Name: ______

ANSWERS

76.01.05.01	1.	D ______
	2.	C ______
	3.	A ______
	4.	D ______
	5.	A ______
7[illegible].01.05.02	6.	A ______
	7.	D ______
	8.	D ______
	9.	D ______
	10.	A ______
76.01.05.03	11.	D ______
	12.	B ______
	13.	A ______
	14.	D ______
	15.	B ______
76.01.05.04	16.	C ______
	17.	A ______
	18.	A ______
	19.	C ______
	20.	A ______

21. ______
22. ______
23. ______
24. ______
25. ______
26. ______
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52. ______
53. ______
54. ______
55. ______
56. ______
57. ______
58. ______
59. ______
60. ______

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File Code: 76.01.05.01.A2-0
Date Published: 8/18/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Operation of an Electric Range

OBJECTIVES:

Describe the operation of an electric range.

Draw a schematic diagram of the electrical circuits for an electric range.

EVALUATION PROCEDURE:

Write a description about the operation of an electric range that is consistent with the attached checklist.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Operation of an Electric Range.
Electric Range.
Home Appliance Servicing, Anderson.

PROCEDURE:

1. Read and study carefully the information found on pages 195-233 in the Home Appliance Servicing.
2. Operate the appliance and observe the characteristics of the appliance following the steps listed on the attached operational checklist.
3. Describe the operation of an electric range and draw a simple schematic of the circuits.
4. Complete the multiple-choice test items for this LAP.
5. Check your answers with the test key. If your answers are all correct,

Principal Author(s): T. Ziller

record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

CHECKLIST: OPERATION OF AN ELECTRIC RANGE

_____ 1. Level range both width and depth.

_____ 2. Turn all control switches to "off".

_____ 3. Connect electric ranges to 240 60HZ 50A.

_____ 4. Turn each surface unit switch to each heat setting (observing the heating element and turning it "off" when checked.

_____ 5. Turn bake and broil unit through each setting and check for proper operation. Turn "off".

_____ 6. Check time clock for operation.

_____ 7. Check timed circuits for proper operation.

_____ 8. Check lighting circuits (surface and oven).

_____ 9. Turn all controls to "off" and disconnect from power.

Student: ______________________ File Code: 76.01.05.01.A2-2

Date: ______________________ Date Published: 7/28/75

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LAP TEST: OPERATION OF AN ELECTRIC RANGE

1. If electric ranges operated on Direct Current, what effect would it have on the contacts in the switches and thermostat?

   a. the contacts would close.
   b. the contacts would respond directly.
   c. the contacts would open.
   d. the contacts would melt together.

2. Electric ranges are not available for a two-wire circuit because:

   a. the voltage needed for the range elements is high.
   b. the lights used on the range is low voltage.
   c. the timing unit used for range oven is low voltage.
   d. the thermostat used in the range oven is high voltage.

3. A Wye-connected, 4-wire, 3-phase, AC power-distribution system with a grounded neutral provides what voltage for electric range service?

   a. 120/208 volts.
   b. 115/230 volts.
   c. D.C.
   d. pulsating D.C.

4. The primary function of an oven unit in an electric range is to:

   a. modulate the current.
   b. preheat the electric range.
   c. heat the oven to a definite temperature.
   d. modulate the voltage.

5. In a 2-unit electric range oven, which switch arrangement in Illustration 2 provides the highest temperature?

   a. 3
   b. 5
   c. 4
   d. 2

6. In a 2-unit electric range oven, which switch arrangement in Illustration 2 represents broil?

   a. 4
   b. 1
   c. 2
   d. 5

7. Switch position No. 1 in Illustration 3 represents what heat temperature for a surface heating element on an electric range?

   a. high heat.
   b. medium heat.
   c. low heat.
   d. simmer.

8. In an electric range heating is accomplished by:

   a. connecting a suitable current to an electric potential.
   b. connecting a suitable resistance across an electric potential, thus causing a current to flow.
   c. causing a resistance to flow through a circuit.
   d. causing a voltage to rise in a circuit.

9. Heat variations on an electric range are usually obtained by:

   a. changing the current flow in the series connected elements.
   b. changing the thermostat variation by changing the control knob.
   c. connecting parallel heat units to form a heating pair.
   d. conntecting two or more elements in series or parallel and/or by varying the voltage supplied to the elements.

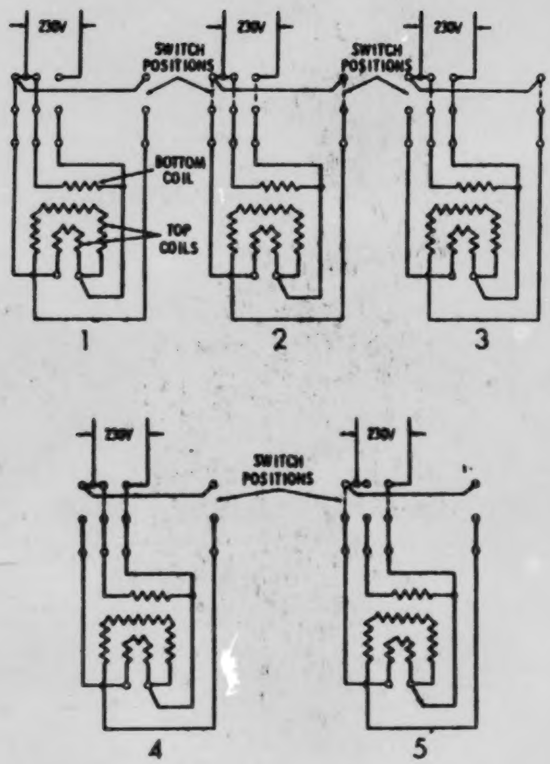

Illustration 2

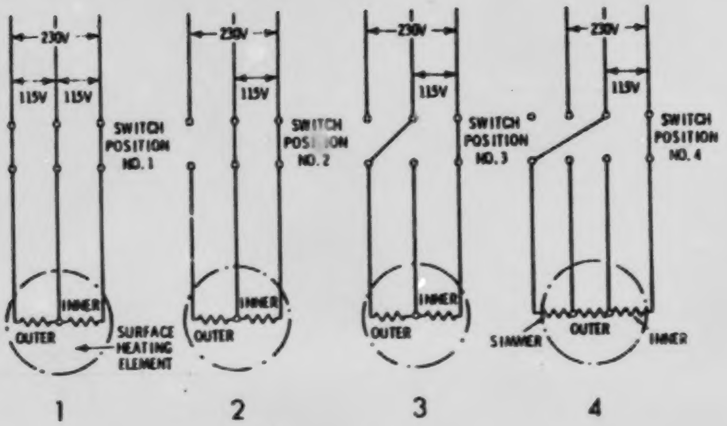

Illustration 3

LAP TEST ANSWER KEY: OPERATION OF AN ELECTRIC RANGE

1. D
2. A
3. A
4. C
5. D
6. D
7. A
8. B
9. D
10. A

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File Code: 76.01.05.02.A2-0
Date Published: 8/18/75

Learning Activity Package

Student: ________________
Date: ________________

PERFORMANCE ACTIVITY: Disassembly of an Electric Range

OBJECTIVES:

Disassemble and identify the parts of an electric range.

EVALUATION PROCEDURE:

Instructor will examine the disassembled appliance for correct disassembly and parts identification in accordance with the attached checklist.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Disassembly of an Electric Range.
Tools and electric range.
Service Manuals for the appliance.

PROCEDURE:

1. Follow the standard procedure for disassembly. (See attached sheet.)
2. Complete the multiple-choice test items for this LAP.
3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): T. Ziller

CHECKLIST: DISASSEMBLY OF AN ELECTRIC RANGE

_____ 1. Unplug range power receptable.

_____ 2. Lift up surface unit heating elements.

_____ 3. Remove surface unit splash pans.

_____ 4. Unplug surface units.

_____ 5. Unplug oven unit heating elements.

_____ 6. Remove retaining screws from back and remove back.

_____ 7. Disconnect individual switches, timers, and thermostat controls from back of range.

_____ 8. Remove individual knobs and dials from controls.

_____ 9. Remove controls.

_____ 10. Remove individual circuit wires and/or wiring harness.

_____ 11. Label and identify each component part of the electric range.

_____ 12. Have the instructor check the identification.

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LAP TEST: DISASSEMBLY OF AN ELECTRIC RANGE

1. Identify by number (Fig. 7), the backsplasher assembly on an electric range.
   - a. 14
   - b. 4
   - c. 20
   - d. 12

2. Identify by number (Fig. 7) the oven rheostat on an electric range.
   - a. 47
   - b. 20
   - c. 28
   - d. 39

3. Identify by number (Fig. 7) the timer on an electric range.
   - a. 37
   - b. 48
   - c. 50
   - d. 32

4. Identify by number (Fig. 7) the unit pan-6" on an electric range.
   - a. 83
   - b. 80
   - c. 82
   - d. 81

5. Identify by number (Fig. 7) the transformer on an electric range.
   - a. 130
   - b. 129
   - c. 128
   - d. 131

6. Identify by number (Fig. 7) the ballast on an electric range.
   - a. 130
   - b. 128
   - c. 129
   - d. 131

7. Identify by number (Fig. 7) the sensor assembly on an electric range.

   a. 131
   b. 135
   c. 154
   d. 203

8. Identify by number (Fig. 7) the lock switch on the latch assembly on the electric range.

   a. 250
   b. 262
   c. 266
   d. 257

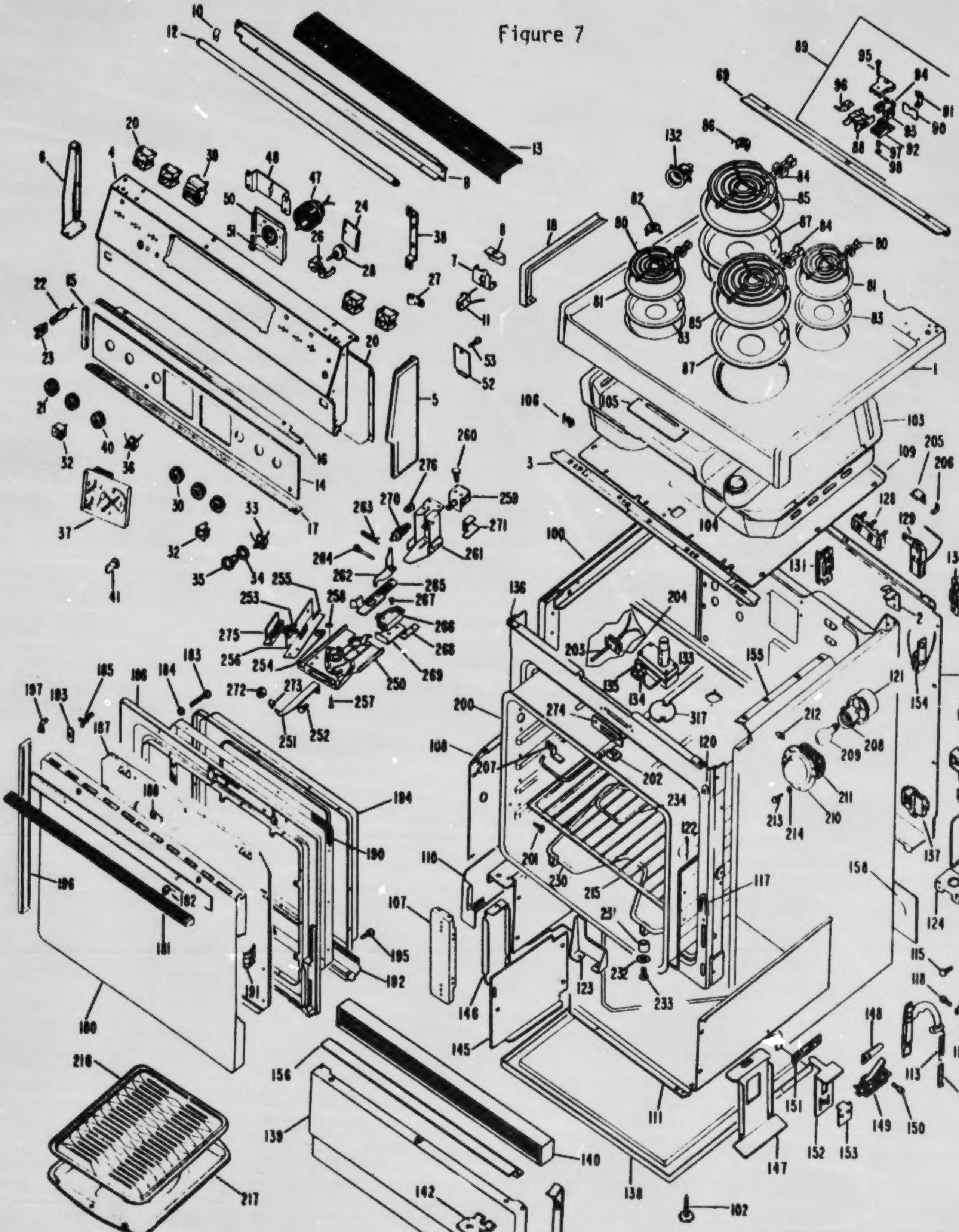
9. Identify by number (Fig. 7) the switch P-7 rotary on an electric range.

   a. 47
   b. 20
   c. 28
   d. 39

10. Identify by number (Fig. 7) the oven light switch on an electric range.

   a. 120
   b. 154
   c. 131
   d. 135

Figure 7



LAP TEST ANSWER KEY: DISASSEMBLY OF AN ELECTRIC RANGE

1. B
2. C
3. A
4. A
5. A
6. D
7. D
8. C
9. D
10. A

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File Code: 76.01.05.03.A2-0

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Diagnosis of Malfunctions in an Electric Range

OBJECTIVE:

Diagnose malfunctions in an electric range using appropriate tools and procedures.

EVALUATION PROCEDURE:

Electrical values found during diagnosis are consistent with specification found on the manufacturer's name plate.

Correctly answer 8 out of 10 items on a multiple choice objective test.

RESOURCES:

Checklist: Diagnosis of Malfunctions - Electric Range.
Tools, test equipment, work order form and an electric range.
Service Manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Diagnosis of Malfunctions - Electric Range.
2. Complete the multiple-choice test items for this LAP.
3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems check with your instructor. When you have correctly completed all the test items you may record your time on your SPR.

Principal Author(s): T. Ziller

CHEKLIST: DIAGNOSIS OF MALFUNCTIONS _ ELECTRIC RANGE

______ 1. Prepare and attached work order.

______ 2. Make a thorough visual inspection.

______ 3. Check line cords. (Ohmmeter). Resistance: ______

______ 4. Check heating elements. (Ohmmeter). Resistance: ______

______ 5. Check thermostat. (Ohmmeter) Resistance: ______

______ 6. Check switches and controls. (Ohmmeter) Resistance: ______

______ 7. Check mechanical seals, fittings, and connections including knobs, feet and grommets.

______ 8. Check all electrical connections.

______ 9. Check condition of insulation and bakelite.

______ 10. Plug into 230 AC (50 amp) power source.

______ 11. Check voltage sources (voltmeter). Voltage: ______

______ 12. Compute the power, in watts, dissipated by the electric range. Compare your computations with the manufacturer's name plate figure. Wattage: ______

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Date: ______________________ Date Published: 7/28/75

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LAP TEST: DIAGNOSIS OF MALFUNCTIONS IN AN ELECTRIC RANGE

1. Measuring the high temperature on an electric range is difficult. A method used for checking a questionable control would be to use a:

   a. ammeter.
   b. thermopile.
   c. voltmeter.
   d. thermocouple.

2. To make an electric range circuit test, it is essential to employ what type of test?

   a. polygraph.
   b. continuity.
   c. pyrometer check.
   d. thermocouple.

3. When using a test lamp circuit test for an electric range, what should be a avoided in a high voltage condition?

   a. electrical shock.
   b. high resistive valves.
   c. low surge current.
   d. high power consumption.

4. When checking the electric range oven unit, the "preheat" position determines:

   a. correct operation of the top and lower oven units.
   b. the "broil" and "bake" signal lamps are off.
   c. that the broil unit is off, the bake unit is on.
   d. that the bake unit is off, the broil unit is on.

5. Check the circuits on the timing device by:

   a. recycling the sequence switch.
   b. going through an entire cycle for each proper setting.
   c. using the automatic clockhand set.
   d. going through half cycle settings.

6. When checking difficulties on inoperative fluorescent lamps on an electric range, first:

   a. turn off the fluorescent switch.
   b. check the ballast for the proper setting.
   c. adjust the transformer for proper voltage.
   d. insepct the terminals on the line terminal block to check if proper current is available.

7. If after replacing both the bulb and the starter the fluorescent lamp on an electric range still fails to operate, the problem is:

   a. in the transformer's core.
   b. in the ballast or the wiring.
   c. in the single-pole double-throw switch.
   d. in the fluorescent bulb filaments.

8. What condition exists on an electric range if there is a wide variation in temperature resulting in the length of time to perform the cooking operation?

   a. too narrow a variation in the thermostat.
   b. too wide of differential in the thermostat.
   c. too high of voltage in the oven.
   d. too high of current in the oven.

9. If after the electric range oven is heated the oven door opens at the top allowing heated air to escape and cool air to enter, what may be the cause?

   a. the insulation has shrunk.
   b. the frame is twisted.
   c. the oven door is too small.
   d. the oven door has improper clearance at the bottom.

10. Adjusting the heat controls on an electric range without first analyzing the source of the trouble may result in:

    a. over current fluctuations.
    b. improper adjustment of controls.
    c. voltage surges.
    d. improper power consumption.

LAP TEST ANSWER KEY: DIAGNOSIS OF MALFUNCTIONS IN AN ELECTRIC RANGE

1. D
2. B
3. A
4. A
5. B
6. D
7. B
8. B
9. D
10. B

File Code: 76.01.05.04.A2-0

Date Published: 8/18/75

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Repair, Service and Reassembly of an Electric Range

OBJECTIVES:

Order replacement parts for the electric range.

Repair, service and reassemble an electric range.

EVALUATION PROCEDURE:

The appliance must operate correctly.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Repair, Service and Reassembly - Electric Range.
Test equipment, tools, appliance parts catalog and requisiton form.
Electric range.
Service manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Repair, Service and Reassembly - Electric Range.

2. Complete the multiple-choice test items for this LAP.

3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): T. Ziller

CHECKLIST: REPAIR, SERVICE, AND REASSEMBLY - ELECTRIC RANGE

Repair and Service:

______ 1. If the surface units are high or low in resistance, replace with proper size and type. (Check schematic for resistive value.)

______ 2. If the bake or broil units are high or low in resistance, replace with appropriate size and type (see parts list).

______ 3. If any of the control switches are faulty, replace.

______ 4. If the Hot Wire relay is not functioning, replace (no adjustments).

______ 5. If timer motor is open, replace.

______ 6. If timer circuit board is the problem, replace the whole circuit board.

______ 7. If the thermocoupler is not operating, replace.

______ 8. If any mechanical adjustments are necessary, use the proper tools.

Reassemble:

______ 1. Insert surface units into the electrical connectors.

______ 2. Insert bake or broil unit into the electrical connector. (Make certain that the asbestos material is between the unit and the range cabinet.)

______ 3. Connect the wire harness to the proper electrical terminals. (Use wiring diagram.)

______ 4. Tighten all mounting bolts or screws.

______ 5. Replace access panel and mount with proper size screws.

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LAP TEST: REPAIR, SERVICE AND REASSEMBLY OF AN ELECTRIC RANGE

1. The first step for installing an electric range should be to:

   a. check surface element for proper wattage.
   b. check pigtail for proper length.
   c. check oven elements for defects.
   d. check all range circuits for proper operation.

2. What procedure is used to level an oven door on an electric range?

   a. use a plumb bob to center the door.
   b. use a level on the doors edge and 'eye it up' with the top of the range.
   c. place a carpenter's level on the oven shelves and shim the range to bring the oven back to a level position.
   d. use a yardstick and measure both sides from the top of the range to the floor.

3. Which of the following electric range adjustments should be avoided whenever possible?

   a. timer adjustments.
   b. door hinge adjustments.
   c. heat control adjustments.
   d. control knob adjustments.

4. The first step before repairing any part of an electric range is to:

   a. check the voltage.
   b. be sure diagnosis is correct.
   c. check the resistance.
   d. keep data sheet information.

5. When replacing the thermal switch, be sure the thermostat capillary is:

   a. in series with the thermostat.
   b. thermally tight.
   c. dressed away from the thermal switch's electrical contacts.
   d. in parallel with the thermostat.

6. When replacing an oven sensor, it is recommended that the connection of the new sensor be:

   a. soldered before the ceramic connectors are installed.
   b. stripped of insulation before installed.
   c. pressurized before installed.
   d. wired before electrical connections are installed.

7. What procedure is followed when repairing a bent latch lever on an electric range?

   a. after removing the latch lever half-way, the lever can then be bent to its normal position.
   b. after removing the bent lever replace with new lever.
   c. bend with screw driver after cutting power.
   d. after removing adjust set screw.

8. Calibration of the oven responder, on an electric range, for bake temperature must be made on the:

   a. knob or dial only.
   b. small adjusting screw inside the oven responder.
   c. outside responder control knob.
   d. in the oven timer.

9. What should be the final step when replacing or repairing a part on an electric range?

   a. call customer to inform job is completed.
   b. figure cost per unit item.
   c. finish data card information.
   d. check operation of the component changed or repaired.

10. The neutral lead (white lead) on an electric range can not be disconnected in accordance with:

   a. lighting display instructions.
   b. National Electrical Code.
   c. Local Labor Code.
   d. Correct Operating Procedures.

LAP TEST ANSWER KEY: REPAIR, SERVICE AND REASSEMBLY OF AN ELECTRIC RANGE

1. D
2. C
3. C
4. B
5. C
6. A
7. A
8. A
9. D
10. B

Student: ______________________ **File Code:** 76.01.05.00.B2-2

Date: ______________________ **Date Published:** 11/18/74

Mountain-Plains Education &
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UNIT POST TEST: ELECTRIC RANGES

76.01.05.01

1. All wiring to an electric range must be in accordance with the requirements of what code?

   a. National Electrical Workers Union Code.
   b. National Board of Directors Code.
   c. National Safety Council Code.
   d. National Electrical Code.

2. The purpose of the 3-wire load-balancing switch for surface cooking units is to distribute the electric range load in what way?

   a. between both legs of the 3-wire system.
   b. between one hot lead and the neutral lead.
   c. between the two neutral leads.
   d. between the common lead and 115VAC.

3. The mechanical position of the electric range oven that may affect baking would be:

   a. left of center line.
   b. levelness of the oven.
   c. perpendicular.
   d. 190° even.

4. In a 2-unit electric range oven, number 4 in Illustration 2 represents the heat value for which of the below?

   a. off.
   b. broil.
   c. bake 2.
   d. preheat.

5. Which of the four switch positions in Illustration 3 illustrates simmer on a surface heating element on an electric range?

   a. 1
   b. 3
   c. 2
   d. 4

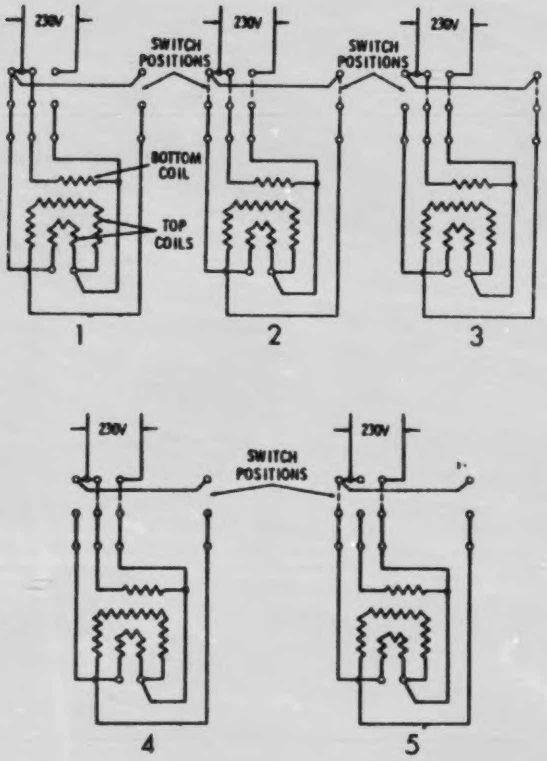


Illustration 2

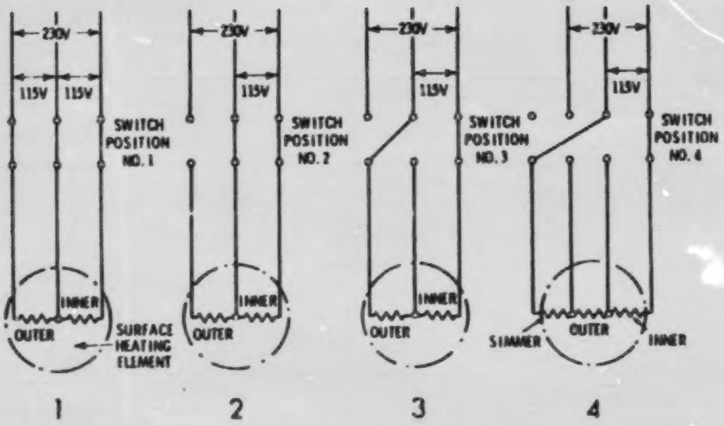
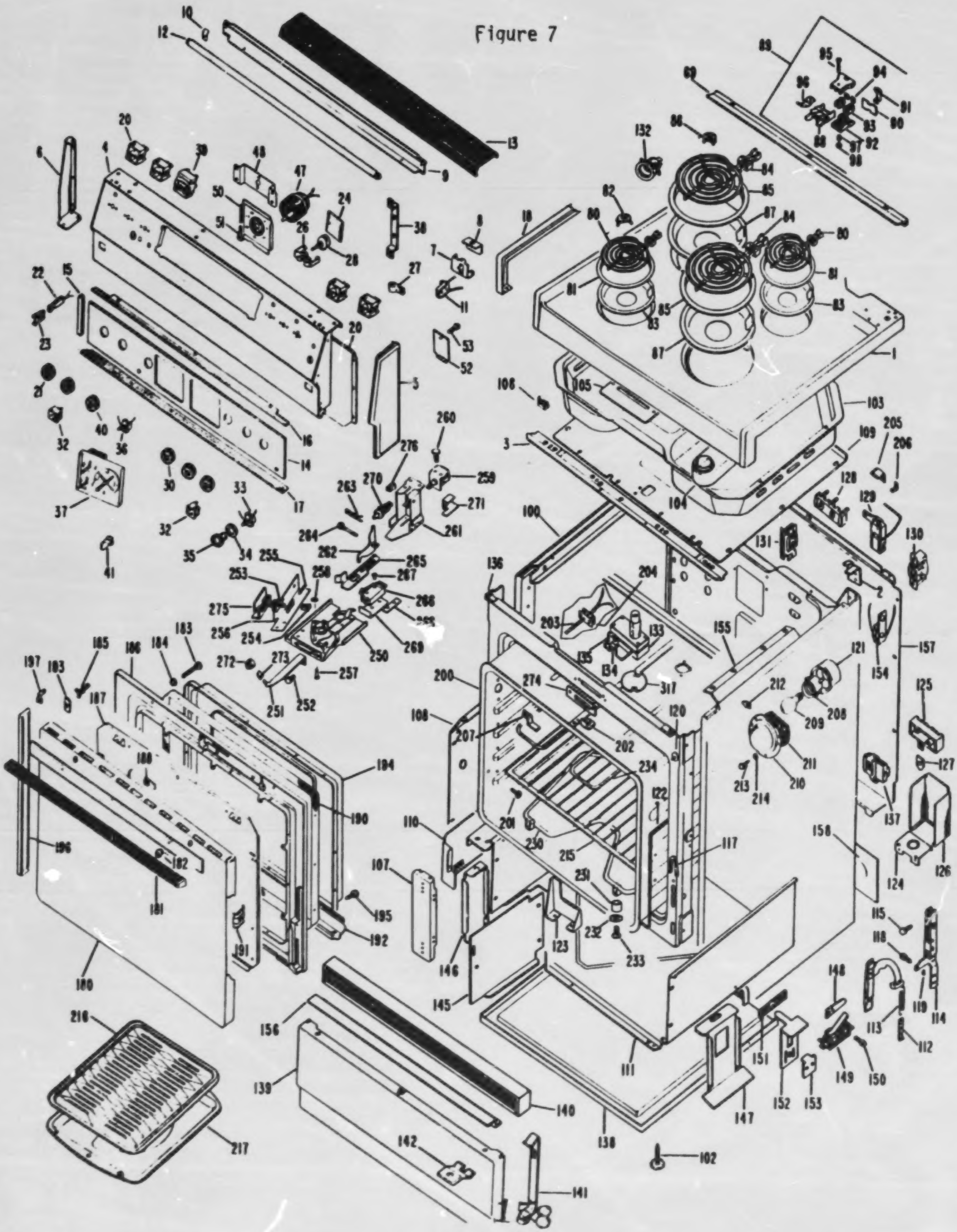


Illustration 3

Figure 7



76.01.05.02

6. Identify by number (Fig. 7) the cooktop on an electric range.
   a. 109
   b. 103
   c. 1
   d. 104

7. Identify by number (Fig. 7) the switch on the surface unit of an electric range.
   a. 47
   b. 20
   c. 28
   d. 39

8. Identify by number (Fig. 7) the circuit board on an electric range.
   a. 39
   b. 11
   c. 24
   d. 47

9. Identify by number (Fig. 7) the hot wire relay on an electric range.
   a. 131
   b. 125
   c. 154
   d. 137

10. Identify by number (Fig. 7) the actuator-switch on an electric range.
    a. 266
    b. 255
    c. 250
    d. 254

76.01.05.03

11. To check the convenience outlet voltage on an electric range, use:
    a. a test lamp.
    b. an ohmmeter.
    c. ammeter.
    d. a test probe.

76.01.05.03 (continued)

12. After connecting the electric range to an electric service, the oven unit circuits are checked following what procedure?

    a. "broil" on; "bake" off; signal on.
    b. signal "on"; "bake" position.
    c. oven switch 350°; "bake" position; "broil" position; "preheat" position.
    d. "bake" on; "broil" off; signal on.

13. Check the warmer unit (if there is one on the electric range) for heating by:

    a. turning on the "preheat" for one complete cycle.
    b. turning on the warmer switch, removing the warmer drawer, and feeling the unit.
    c. turning on the "bake" for 5 minutes.
    d. turning on the "broil" for 2 minutes.

14. What condition exists if an electric range is drying or burning causing excess temperatures?

    a. the thermostat is miscalibrated.
    b. the thermostat is too high.
    c. the voltage is too high.
    d. the current is too high.

15. What condition may exist if during baking operations in an electric range oven, browning cannot be attained?

    a. the thermostat is set too low.
    b. the temperature is too high.
    c. the upper and lower oven units have been interchanged after removal for cleaning.
    d. the elements are faulty.

76.01.05.04

16. A defective differential in the thermostat on an electric range requires:

    a. the oven thermostat must be replaced.
    b. the differential must be replaced.
    c. the oven thermostat must be adjusted.
    d. the differential must be adjusted.

17. A noisy transformer can be effectively reduced, if not eliminated, by:

    a. installing a felt pad under the transformer.
    b. disconnecting the transformer.
    c. bypassing the transformer.
    d. installing a resistive shunt.

76.01.05.04 (continued)

18. Replacement of the dual range thermostat requires:

    a. back splash servicing.
    b. front and rear servicing.
    c. cooktop servicing.
    d. oven servicing.

19. When replacing a burned-out solenoid in an electric range, replace the:

    a. ballast and transformer before the new solenoid.
    b. solenoid before rewinding.
    c. plunger before rewinding.
    d. solenoid coil and plunger to insure proper operation.

20. Which of the following is a good service practice on an electric range?

    a. unplug the range before servicing.
    b. use friction tape to cover connections.
    c. leave jumpers on components.
    d. lubricate bearings.

UNIT TEST ANSWER SHEET
POST TEST

Occupational Area: ______
File Code: 76.01.05.00.B2-2
Name: ______

ANSWERS

76.01.05.01
1. D______
2. A______
3. B______
4. C______
5. D______

6.01.05.02
6. C______
7. B______
8. C______
9. D______
10. D______

76.01.05.03
11. A______
12. C______
13. B______
14. A______
15. C______

6.01.05.04
16. A______
17. A______
18. B______
19. D______
20. A______

21. ______
22. ______
23. ______
24. ______
25. ______
26. ______
27. ______
28. ______
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42. ______
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47. ______
48. ______
49. ______
50. ______
51. ______
52. ______
53. ______
54. ______
55. ______
56. ______
57. ______
58. ______
59. ______
60. ______

Student: ______________________ File Code: 76.01.05.00.A1-5

Date: ______________________ Date Published: 11/13/74

Family Pay Number: __________ Sex: M F (Circle 1)

Mountain-Plains Education &
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UNIT PERFORMANCE TEST: ELECTRIC RANGES

OBJECTIVE 1:

Given a malfunctioning electric range, the student will service and repair an electric range so that it functions according to the manufacturer's specifications, following safe practices and procedures.

OBJECTIVE 2:

Using appropriate tools and test equipment, the student will calculate and record amperage, voltage, resistance, and wattage of electric range.

TASK:

The student will service and repair a malfunctioning electric range and, in the process, he will take and record amperage, voltage, resistance and wattage readings, using appropriate test equipment.

ASSIGNMENT:

CONDITIONS:

The student will be given a malfunctioning electric range (it may be bugged by the instructor or it may be one brought in by a customer). He will be required to service and repair the electric range in conditions similar to those in a typical appliance repair shop. He will be allowed to use any and all tools, equipment, service manuals, text books, etc., commonly found in a repair shop. He must complete it in a reasonable length of time with no assistance from the instructor(s) or students.

RESOURCES:

Tools:

Amprobe RS-3 Rotary Meter (B-A)
Soldering gun 100 to 140 watt
Adjustable Wrench
Nut Driver Set
Long Nose Pliers
Diagonal Cutters
Slip Joint Pliers
Screwdriver Set
Phillips Set
Hex & Spline Wrench Kit
Vise Grip Plier Model Size 7"
Utica Electrician's Knife, Standard Size
18" Aluminum Level
12' Steel Tape
Punch & Chisel Set, 1/2", 5/8" chisels; 3/16, 3/8, 5/32 punches
Combination Wrench Set
Hammer (Ball Peen) 12 oz.
10" Channel-lock Plier
Utility Box
VOM
Assortment of wire, fasteners and repair parts
Electric Range

Printed Material:

Various Repair Manuals
Manufacturer's Specification Sheets

Student: ______________________ **File Code:** 76.01.05.00.A1-5

Date: ______________________ **Date Published:** 11/13/74

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PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Follows safe practices and procedures.		
Criterion: No injury results to the student or the equipment and complies with OSHA requirements.		
2. Follows proper procedures for disassembly.		
Criterion: No damage results to the appliance.		
3. Diagnosis and troubleshoots malfunctions properly.		
Criterion: When repaired, the appliance functions according to the manufacturer's specifications.		
4. Reassembles the appliance properly.		
Criterion: Appliance functions according to the manufacturer's specifications and the procedures followed agree with those described in the service literature.		
5. The repaired appliance is repaired in a neat, professional manner.		

(Checklist continued)

	CRITERION	
	Met	Not Met
Criterion: No damage results to the appliance such as scratches and dents.		
6. All connections and fastening are properly completed.		
Criterion: The appliance connection complies with the Manufacturer's specifications. The connection is mechanically fastened and structurally sound. The connection is electrically fastened and free of defects.		
7. Appliance functions according to the manufacturer's specifications.		
Criterion: Manufacturer's specifications.		
8. Uses appropriate repair part and supplies.		
Criterion: They match exactly those listed in the manufacturer's specifications.		
Objective 2:		
9. Uses test equipment properly.		
Criterion: Manufacturer's specifications.		
10. Wattage readings are accurate.		
Criterion: Manufacturer's specifications.		
11. Voltage readings are accurate.		
Criterion: Manufacturer's specifications.		

(Checklist continued)

	CRITERION	
	Met	Not Met
12. Amperage readings are accurate.		
Criterion: Manufacturer's specifications.		
13. Resistance readings are accurate.		
Criterion: Manufacturer's specifications.		
14. When applicable mathematical calculations are correct.		
Criterion: AC/DC Circuit Manuals, Westinghouse.		
15. The appliance is repaired in a reasonable time.		
Criterion: Not to exceed 2 hours.		
Student must successfully complete 13 out of 15 line items to		
achieve an overall score of satisfactory.		

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Mountain-Plains Education &
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Program, Inc.
Glasgow AFB, Montana 59231

Learning Experience Guide

UNIT: GAS RANGES

RATIONALE:

Every appliance serviceman is expected to service and repair various types of gas ranges. To be an effective serviceman, he must understand how a particular appliance works.

PREREQUISITES:

76.01.05 Unit: Electric Ranges

OBJECTIVES:

Operate; disassemble; diagnose malfunctions; repair, replace or service component parts; and reassemble a gas range according to maufacturer's specifications using appropriate service manuals, equipment and tools, and following safe practices.

Identify characteristics of operation, components; and diagnostic repair and service procedures for gas ranges.

RESOURCES:

Printed Materials

Appliance Service Manuals for appliances used in the program.
Catalogs, appliance supply (assortment).
Home Appliance Servicing. Edwin P. Anderson, 2nd Edition, Theordore Audel and Company, Indianapolis, Indiana, 1965.
Order Forms
Work Order Forms
Manufacturer's specification sheets.

Equipment

Test Equipment: Amprobe (RS-3 Rotary Meter B-A).
Meter, volt-ohm.

Principal Author(s): T. Ziller

Tools:

Box, utility.
Chisels, (½" and 5/8").
Cutters, diagonal.
Gun, soldering (100-140 watt).
Hammer, ball pein (12 oz.).
Kit, solderless terminal.
Knife, electricians.
Level, aluminum 18".
Nut driver set.
Pliers, channel-lock (10").
Plier, long nose.
Plier, slip joint.
Plier, vise grip (size 7").
Puncher (3/16", 3/8" & 5/32").
Screwdriver, blade (set).
Screwdriver, Phillips (set).
Tape, steel measuring (12 ft.).
Wrench, adjustable.
Wrench, combination set.
Wrench, hex & spline (kit).

GENERAL INSTRUCTIONS:

This unit consists of four Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(9) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Operation of a Gas Range
.02 Disassembly of a Gas Range
.03 Diagnosis of Malfunctions in a Gas Range
.04 Repair, Service and Reassembly of a Gas Range

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

After reading this unit guide, obtain the LAP for the first assigned performance activity.

Student: ______________________ File Code: 76.01.06.00.A2-2

Date: ______________________ Date Published: 11/18/74

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UNIT PRETEST: GAS RANGES

76.01.06.01

1. The snap-action-type thermostat on a gas range is one in which the thermostatic valve:

   a. travels instantly from the closed to the open position, or vice versa.
   b. travels through the gas main to the valve.
   c. ignites the gas burner.
   d. extinguishes the pilot in case of a malfunction.

2. What part of the thermostat on a gas range may be normally adjusted daily?

   a. air shutter.
   b. gas main valve.
   c. pilot height adjustment screw.
   d. temperature dial.

3. What part on a gas range is used to control the minimum amount of gas to the oven burner, even though the main thermostat valve is closed?

   a. oven control knob.
   b. bypass flame adjustment.
   c. pilot orifice.
   d. the oven burner itself.

4. The function of an automatic gas range pan control is to:

   a. control the gas to the pilot that ignites the burner.
   b. adjust the pans on the surfaces burners to fit the cook
   c. automatically adjusts the surface cooktop to fit a fry pan.
   d. reduce the gas to the burner as the pan temperature approaches the preset dial.

5. The advantage of the ring burner on a gas range is:

   a. that the gas flows freely into the ring type burner.
   b. that it is easier to clean the burner.
   c. that the flame hits the cooking pans better.
   d. that it provides a better supply of secondary air to all parts of the flame.

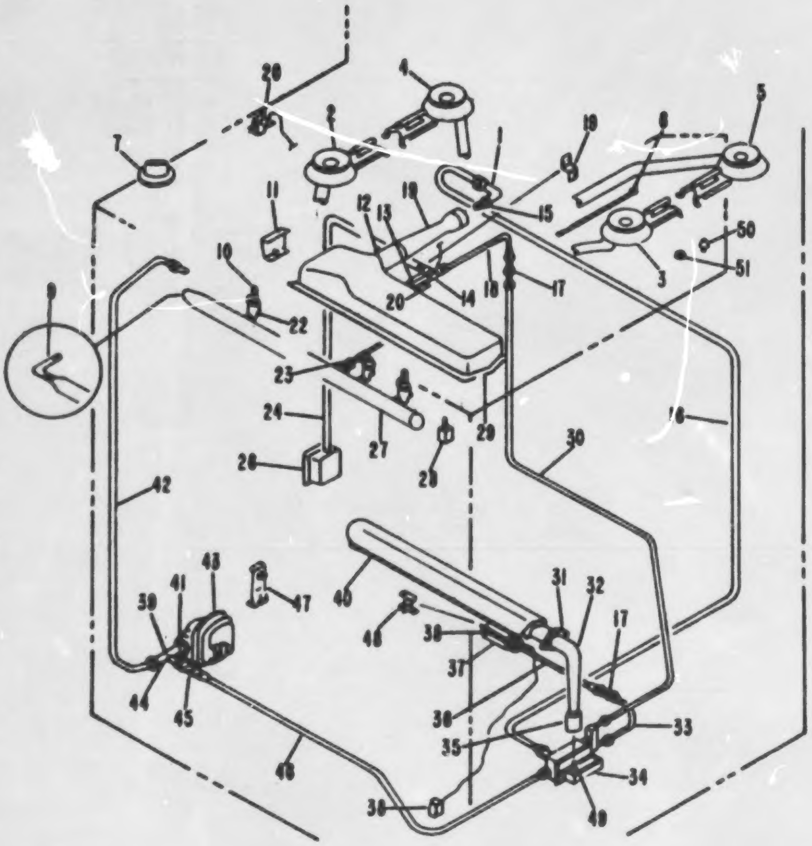
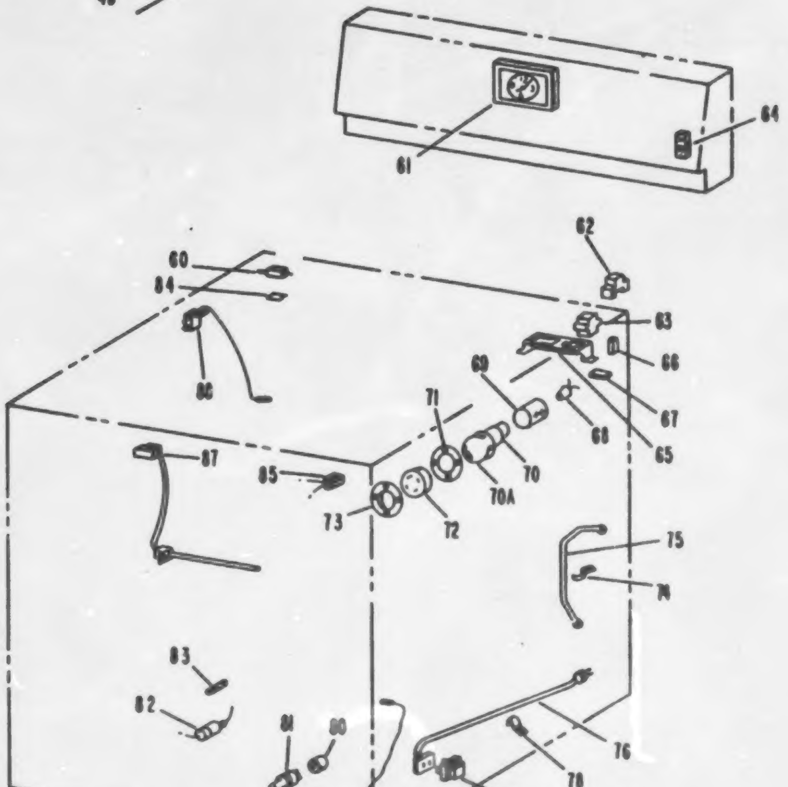


Figure 8

Gas line components



Fiqure 9

Electrical parts

76.01.06.02

6. Identify by number (Fig. 8) the flame switch oven on a gas range.

   a. 48
   b. 37
   c. 17
   d. 38

7. Identify by number (Fig. 8) the oven burner lower on a gas range.

   a. 19
   b. 38
   c. 27
   d. 40

8. Identify by number (Fig. 9) the timer clock on a gas range.

   a. 73
   b. 64
   c. 61
   d. 71

9. Identify by number (Fig. 9) the oven lamp on a gas range.

   a. 63
   b. 71
   c. 72
   d. 70A

10. Identify by number (Fig. 9) the power cord on a gas range.

   a. 77
   b. 76
   c. 79
   d. 81

76.01.06.03

11. If a gas range oven won't heat, check:

   a. door switch.
   b. electrical connections.
   c. thermostat.
   d. timer control.

76.01.06.03 (continued)

12. If gas range lights will not work, check:

    a. control knob.
    b. connections to gas source.
    c. connections to power source.
    d. pilot light.

13. If gas range clock will not work, check:

    a. connections to the timer.
    b. connections to the gas source.
    c. wires and connections.
    d. the clock motor switch.

14. In a top-lighter gas range, an incomplete combustion of gas causing an odor and carbon deposits is the result of:

    a. leak around lighter valve system.
    b. pilot flame in contact with lighter.
    c. clogged valve.
    d. lighter out.

15. What method should be avoided to test for leaks when the gas range is in place and the gas supply line is connected to it?

    a. sniff test.
    b. a solution of soap and water.
    c. open flame.
    d. pyrometering.

76.01.06.04

16. To obtain correct flame character on the top burner on a gas range you would adjust which of the following?

    a. pilot light.
    b. control knob.
    c. air shutter on the manifold.
    d. orifice hood on the valve.

17. On a typical push-button-type gas range lighter, if it leaks around the push button, what procedure should be followed?

    a. use silicone packing.
    b. replace graphite packing.
    c. replace rubber washer.
    d. use a water pump pliers.

76.01.06.04 (continued)

18. Pilot outage and odor are sometimes experienced with gas range lighters that have a solid top lighter hood and can be adjusted by which of the following methods?

    a. tap the threads with a 1/2" tap to seat gas valve.
    b. turn a set screw counter clockwise on the air shutter.
    c. use 1/2" wrench to turn the orifice locknut.
    d. drill 1/2" diameter hole in top of hood.

19. To prevent leakage around threaded joints on a gas range pipe which of the following would be recommended?

    a. grease lubricant.
    b. liquid soap.
    c. joint compound and gas line gaskets.
    d. liquid solder.

20. If a gas range heater pilot flame does not burn properly a high gas pressure, correction is made by:

    a. installing a thermocouple.
    b. installing a bypass flame.
    c. installing dual gas main controls.
    d. installing a pressure regulator.

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UNIT PRETEST: MIXERS AND BLENDERS

76.02.01.01.

1. When operating a food mixer for a continuous length of time, the motor may:

   a. slow down.
   b. overheat.
   c. stop.
   d. become warm, but will not affect its operation.

2. In mixers equipped with bowl turntables, or revolving discs, the position of the beaters is adjusted by means of a:

   a. control-plate assembly.
   b. governor control.
   c. lever arrangement.
   d. turntable slip-clutch.

3. The ejection of the beaters of a food mixer is accomplished through the hollow spindle shafts by:

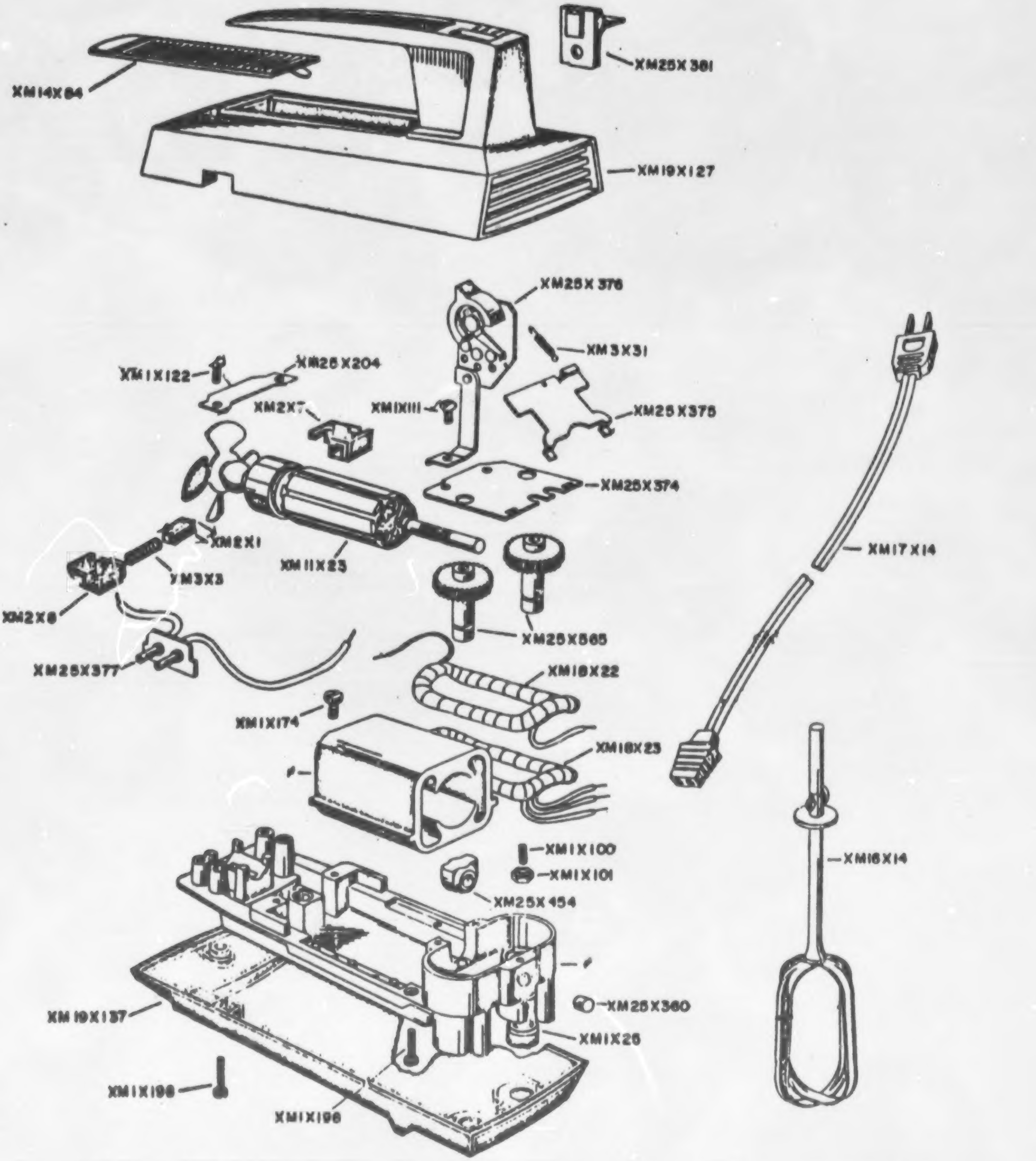
   a. a spring returned push-out plate.
   b. a hook on the spindle.
   c. a notch on the handle.
   d. reversing the motor.

4. The beater speed on a food mixer is directly related to:

   a. turns ratio formula.
   b. the gear selection.
   c. the armature speed.
   d. control knob setting.

5. Armature speed on a food mixer is controlled by:

   a. the governor switch.
   b. a thermo-switch.
   c. the lever control.
   d. a mercury switch.


XM14X84
XM25X381
XM19X127
XM25X376
XM3X31
XM1X122
XM25X204
XM2X7
XM1X111
XM25X375
XM25X374
XM2X1
XM11X23
YM3X3
XM2X6
XM17X14
XM25X565
XM25X377
XM18X22
XM1X174
XM18X23
XM1X100
XM1X101
XM25X454
XM16X14
XM25X360
XM19X137
XM1X26
XM1X198
XM1X196
XM1X111
XM1X195

MIXER Fig. 1

76.02.01.02.

6. Locate by number the field coil upper in Fig. 1 of an electric food mixer.

   a. XM18X22
   b. XM11X23
   c. XM25X565
   d. XM25X374

7. Locate by number the brush holder assembly L.H. in Fig. 1 of the electric food mixer.

   a. XM11X23
   b. XM1X122
   c. XM2X1
   d. XM2X8

8. Locate by number the spindle washer in Fig. 1 of the electric food mixer.

   a. XM25X454
   b. XM16X14
   c. XM1X25
   d. XM1X100

9. Locate by number the brush spring in Fig. 1 of the electric food mixer.

   a. XM2X7
   b. XM2X1
   c. XM3X3
   d. XM1X122

10. Locate by number the field coil,lower in Fig. 1 of the electric food mixer.

    a. XM1X25
    b. XM18X23
    c. XM25X360
    d. XM1X101

76.02.01.03.

11. If the food mixer is noisy during operation, check:

    a. end play of armature.
    b. rough varnish on the windings.
    c. cracked brushes.
    d. too much lubrication.

76.02.01.03. (continued)

12. If there is insufficient speed on the food mixer, check:

    a. for a bind in the bearing or spindles.
    b. wire connections for parallel hook-up.
    c. series shunt resistor.
    d. current limitor device.

13. If there is no low speed on a food mixer, what may cause this condition?

    a. burnt resistor.
    b. open resistor.
    c. shorted resistor.
    d. open capacitor

14. The food mixer spindle speed can be checked by what instrument?

    a. pyrometer.
    b. tachometer.
    c. cramometer
    d. barometer

15. If a food mixer has a surging motor, check:

    a. the surge resistor.
    b. the actuator for restraint in movement.
    c. the motor master control.
    d. the centrifugal switch.

76.02.01.04.

16. If food mixer still has no power after cleaning contacts and checking connection, follow what procedure?

    a. file the points on the control plate.
    b. replace the power cord.
    c. replace control-plate assembly.
    d. resolder the electrical connection.

17. If ball in end of armature shaft is worn or flat; in a food mixer, correct by:

    a. disassembling food mixer completely and replacing ball.
    b. disassembling motor and replacing ball.
    c. ball should be replaced with a cylinder of brass.
    d. ball can be replaced with asbestos packing.

76.02.01.04. (continued)

18. **After the food mixer field tap is pried loose, what can be separated from the motor frame?**

    a. bearing assembly.
    b. armature and field coil.
    c. starting switch assembly.
    d. the fan.

19. **Whenever an actuator or regulator assembly is replaced on a food mixer, the** tip of the actuator should be lubricated with:

    a. SAE 30
    b. a low temperature grease.
    c. a measured amount of grease.
    d. a high temperature grease.

20. What procedure should be followed when reinstalling spindles on a food mixer?

    a. slots should be 36° relative to each other to avoid beater clash.
    b. slots should be 90° relative to each other to avoid beater clash.
    c. slots should be 45° relative to each other to avoid beater clash.
    d. slots should be 180° relative to each other to avoid beater clash.

76.02.01.05.

21. The vertically mounted blender motor is connected to the driver sprocket:

    a. double belts.
    b. indirectly.
    c. offset gears.
    d. directly.

22. Blender speed control may be regulated by:

    a. resistor calibrations.
    b. line voltage changes.
    c. potentiometer settings.
    d. hi-off-low toggle switch.

23. Which type of electric motor is used in a blender?

    a. poly-phase.
    b. shaded-pole.
    c. split-phase.
    d. universal.

76.02.01.05. (continued)

24. Why do blender motor brushes have to be free to move in their holders?

    a. the spring tension would not be able to push brushes against the commutator.
    b. to connect the station to the commutator effectively.
    c. to allow for expansion and contraction of the magnetic field.
    d. to allow for variation in the size of the magnetic field.

25. How is electricity fed to the armature windings when they are spinning around?

    a. static field.
    b. when solenoid is open.
    c. electricity passing through a solid connection.
    d. each coil is connected to copper segments.

76.02.01.06.

26. Identify by number (Fig. 2) the driver sprocket on a blender.

    a. XM25X579
    b. XM1X202
    c. XM1X194
    d. XM25X439

27. Identify by number (Fig 2) the pushbutton switch on a blender.

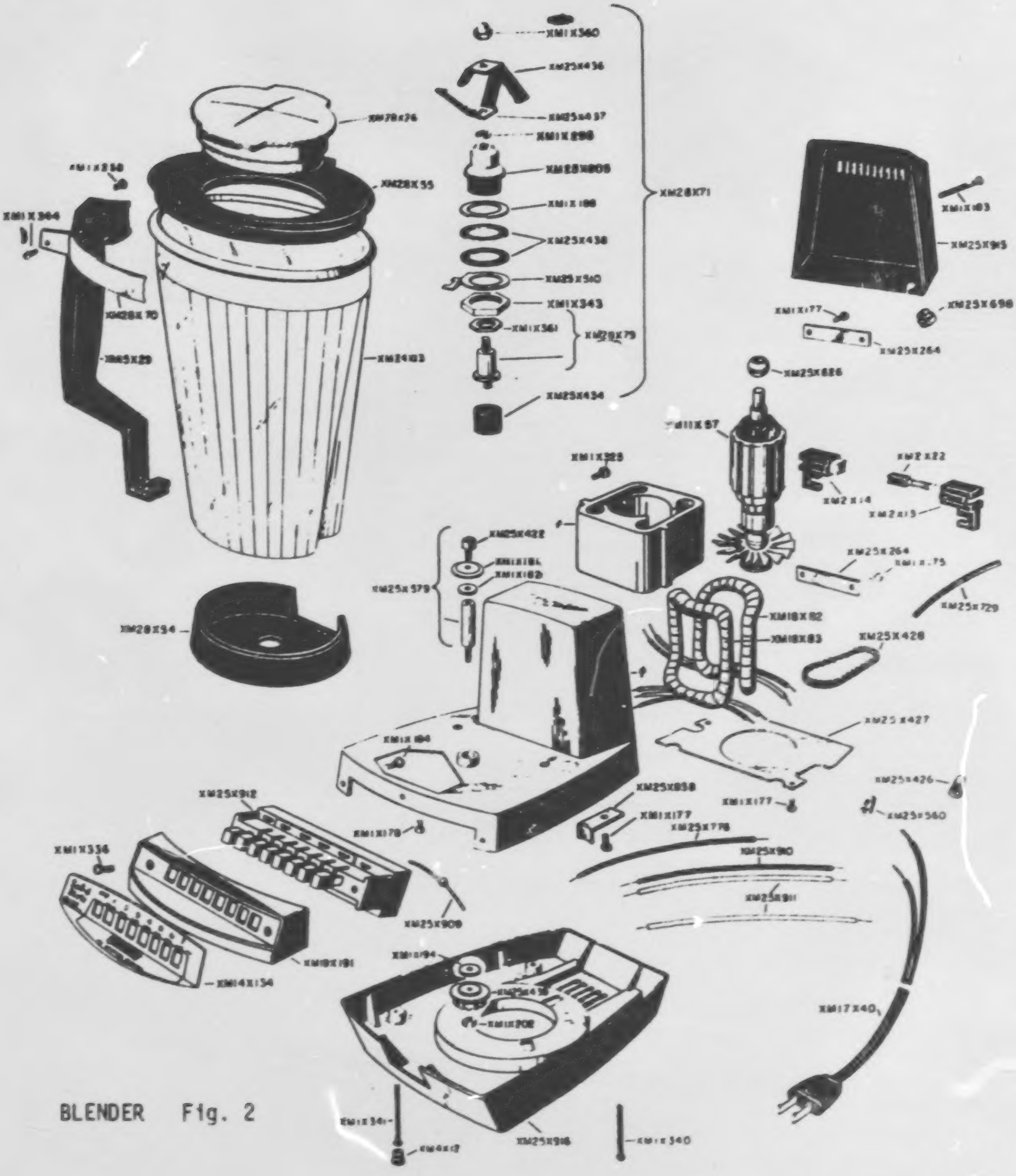
    a. XM25X909
    b. XM19X191
    c. XM25X912
    d. XM14X134

28. Identify by number (Fig. 2) the diode switch on a blender.

    a. XM25X909
    b. XM25X912
    c. XM25X910
    d. XM25X911

29. Identify by number (Fig. 2) the jar fitting assembly on a blender.

    a. XM25X438
    b. XM24X13
    c. XM28X79
    d. XM28X71



BLENDER Fig. 2

76.02.01.06. (continued)

30. Identify by number (Fig. 2) the brush assembly on a blender.

    a. XM2X13
    b. XM2X22
    c. XM25X729
    d. XM25X428

76.02.01.07.

31. To check for switch continuity on a blender use what instrument?

    a. ohmmeter.
    b. ammeter.
    c. pyrometer.
    d. voltohmmeter.

32. Excessive clearance between the driver shaft and the driver bearing on a blender will cause:

    a. blender will not run.
    b. clattering noise.
    c. blender will run but only on low speed.
    d. blender will run but only on high speed.

33. If blender runs only at one speed, what procedure should be followed?

    a. check power source.
    b. check trimmer on the control.
    c. visually check connections.
    d. check heat limit switch.

34. Check the cutter shaft for being frozen or broken if what condition exists?

    a. erratic speeds.
    b. motor runs but blades won't turn.
    c. motor won't run.
    d. no variation of speeds.

35. Too tight belt on the blender will cause what condition?

    a. noisy blender.
    b. high watts and low speeds.
    c. motor runs but blades won't turn.
    d. blender runs only at one speed.

76.02.01.08.

36. If there is a loose fit between the spindle and bearing, correct by:

    a. building up the spindle with solder.
    b. replacing the bearing.
    c. replacing both parts.
    d. tightening the bearing.

37. When installing blades on a blender, what procedure should be followed first?

    a. align the motor with the jar assembly.
    b. preassembly the new spindle.
    c. check the shaft size.
    d. disconnect the jar assembly.

38. Before installing the base and back covers of a blender, check:

    a. the thermal cut out (reset).
    b. motor oil.
    c. control knob (attach).
    d. leads.

39. To replace the escutcheon, be certain it is:

    a. leak proof.
    b. correctly positioned the first time.
    c. correctly tempered.
    d. movable.

40. The only components of the blender motor that are available for replacement are the:

    a. the starting switch.
    b. the bearing.
    c. the starting winding.
    d. carbon brushes.

UNIT TEST ANSWER SHEET

PRETEST

Occupational Area: ____________
File Code: 76.01.06.00.A2-2
Name: ____________

ANSWERS

76.01.06.01 1. A ____
2. D ____
3. B ____
4. D ____
5. D ____
76.01.06.02 6. D ____
7. D ____
8. C ____
9. D ____
10. B ____
76.01.06.03 11. C ____
12. C ____
13. C ____
14. B ____
15. C ____
76.01.06.04 16. C ____
17. B ____
18. D ____
19. C ____
20. D ____

21. ____
22. ____
23. ____
24. ____
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55. ____
56. ____
57. ____
58. ____
59. ____
60. ____

File Code: 76.01.06.01.A2-0

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Learning Activity Package

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Operation of a Gas Range

OBJECTIVES:

Describe the operation of a gas range.

Draw a schematic diagram of the electrical circuits (if applicable).

EVALUATION PROCEDURE:

Student is to write a description about the operation of a gas range that is consistent with the attached checklist.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Operation of a Gas Range.
Gas Range.
Home Appliance Servicing, Anderson.

PROCEDURE:

1. Read and study carefully the information found on pages 234-253 in the Home Appliance Servicing.
2. Operate the appliance and observe the characteristics of the appliance following the steps listed on the attached operational checklist.
3. Describe the operation of a gas range. Draw a simple schematic of the electrical circuits, if appropriate.
4. Complete the multiple-choice test items for this LAP.

Principal Author(s): T. Ziller

5. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

CHECKLIST: OPERATION OF A GAS RANGE

_____ 1. Level range. (Both width and depth).

_____ 2. Connect range to gas source and electrical power.

_____ 3. Turn on gas supply valve. (Check for leaks using soap solution).

_____ 4. Remove burner trays and light surface unit pilots. (Adjust pilot for clean blue flame, ½" long).

_____ 5. Light oven pilot. (Adjust pilot for clean flame, ½" long.)

_____ 6. Turn on individual surface units. (Pilots should ignite surface burners through flash tubes.)

_____ 7. Adjust air shutters for clean blue flame.

_____ 8. Turn off surface burners and turn on overn burner. (Keep oven door closed until you hear oven burner ignite.)

NOTE: A graduating or snap switch controls the oven temperature by regulating the amount of gas to the burner.

_____ 9. Turn off oven burner, disconnect from gas and electrical power and let cool.

Student: ____________________ File Code: 76.01.06.01.A2-2

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LAP TEST: OPERATION OF A GAS RANGE

1. On a manually-lighted gas oven burner name the device used to reignite the bypass flame of the main burner if the flame should become extinguished:

   a. assist pilot
   b. thermocouple.
   c. extra burner.
   d. automatic pilot light.

2. The function of the range regulator on a gas range is to:

   a. mix the air with the gas.
   b. filter the gas flow.
   c. dehydrate the gas.
   d. maintain a constant gas pressure at the burner orifices.

3. The automatic shutoff on a gas range is used to:

   a. terminate gas supply to the range.
   b. terminate the gas supply to the main burner.
   c. terminate the gas supply to the oven burner if the constant-burning pilot light goes out.
   d. regulate the gas to the range burners.

4. A double-duty gas valve on gas ranges offers gas volume control to:

   a. adjust the pilot to a height of 3/16".
   b. set the main valve to either L.P. or natural gas.
   c. adjust the flame to burn clean and clear.
   d. the center simmer, the main burner parts, and the combination of the simmer and the main burner section.

5. What part on a gas range consists essentially of a device actuated by temperature changes that is designed to control the gas supply to the oven burner?

   a. oven heat control.
   b. oven switch.
   c. oven thermopile.
   d. oven thermometer.

6. A graduating-type thermostat on a gas range is one in which the motion of the thermostatic valve is:

   a. directly proportional to the effective motion of the thermal element induced by the temperature change.
   b. indirectly proportional to the effective motion of the thermal element induced by the temperature change.
   c. connected to the main gas valve.

7. What part of the thermostat on a gas range may be normally adjusted daily?

   a. air shutter.
   b. gas main valve.
   c. pilot height adjustment screw.
   d. temperature dial.

8. The bypass on a gas range is:

   a. a device that uses a bypass capacitor.
   b. dependent on the thermostatic valve.
   c. the controlling device on the electric range.
   d. entirely independent of the thermostatic valve.

9. What part on a gas range is used to control the minimum amount of gas to the oven burner, even though the main thermostat valve is closed?

   a. oven control knob.
   b. bypass flame adjustment.
   c. pilot orifice.
   d. the oven burner itself.

10. The function of an automatic gas range pan control is to:

   a. control the gas to the pilot that ignites the burner.
   b. adjust the pans on the surfaces burner's to fit the cooktop.
   c. automatically adjusts the surface cooktop to fit a fry pan.
   d. reduce the gas to the burner as the pan temperature approaches the preset dial.

LAP TEST ANSWER KEY: OPERATION OF A GAS RANGE

1. A
2. D
3. C
4. D
5. A
6. A
7. D
8. D
9. B
10. D

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Date Published: 8/18/75

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: ~~Disassembly of a Gas Range~~

OBJECTIVES:

Disassemble and identify the parts of a gas range.

EVALUATION PROCEDURE:

Instructor will examine the disassemble appliance for correct disassembly and parts identification in accordance with the attached checklist.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Disassembly of a Gas Range.
Tools and a gas range.
Service Manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Disassembly of a Gas Range.

2. Complete the multiple-choice test items for this LAP.

3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): T. Ziller

CHECKLIST: DISASSEMBLY OF A GAS RANGE

______ 1. Shut off gas supply.

______ 2. Disconnect gas supply fittings.

______ 3. Unplug electrical power if so equipped.

______ 4. Remove surface burners.

______ 5. Remove oven and broiler burner.

______ 6. Disconnect and remove oven heat-control systems. (Including ignitor, thermostat, and safety valve assembly).

______ 7. Identify each component part by labeling it.

______ 8. Have the instructor check the identification.

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LAP TEST: DISASSEMBLY OF A GAS RANGE

1. Identify by number (Fig. 8) the burner assembly-RR on a gas range.

   a. 15
   b. 5
   c. 19
   d. 14

2. Identify by number (Fig. 8) the orifice spud no. 49 on a gas range.

   a. 1
   b. 15
   c. 17
   d. 20

3. Identify by number (Fig. 8) the manifold on a gas range.

   a. 19
   b. 27
   c. 24
   d. 1

4. Identify by number (Fig. 8) the gas valve assembly on a gas range.

   a. 17
   b. 49
   c. 33
   d. 34

5. Identify by number (Fig. 8) the pilot assembly oven on a gas range.

   a. 39
   b. 38
   c. 37
   d. 36

6. Identify by number (Fig. 8) the flame switch oven on a gas range.

   a. 48
   b. 37
   c. 17
   d. 38

7. Identify by number (Fig. 8) the pressure regulator on a gas range.

   a. 47
   b. 41
   c. 39
   d. 43

8. Identify by number (Fig. 9) the timer clock on a gas range.

   a. 73
   b. 64
   c. 61
   d. 71

9. Identify by number (Fig. 9) the power cord on a gas range.

   a. 77
   b. 76
   c. 79
   d. 81

10. Identify by number (Fig. 9) the bake/broil clean thermostat on a gas range.

   a. 88
   b. 85
   c. 64
   d. 87

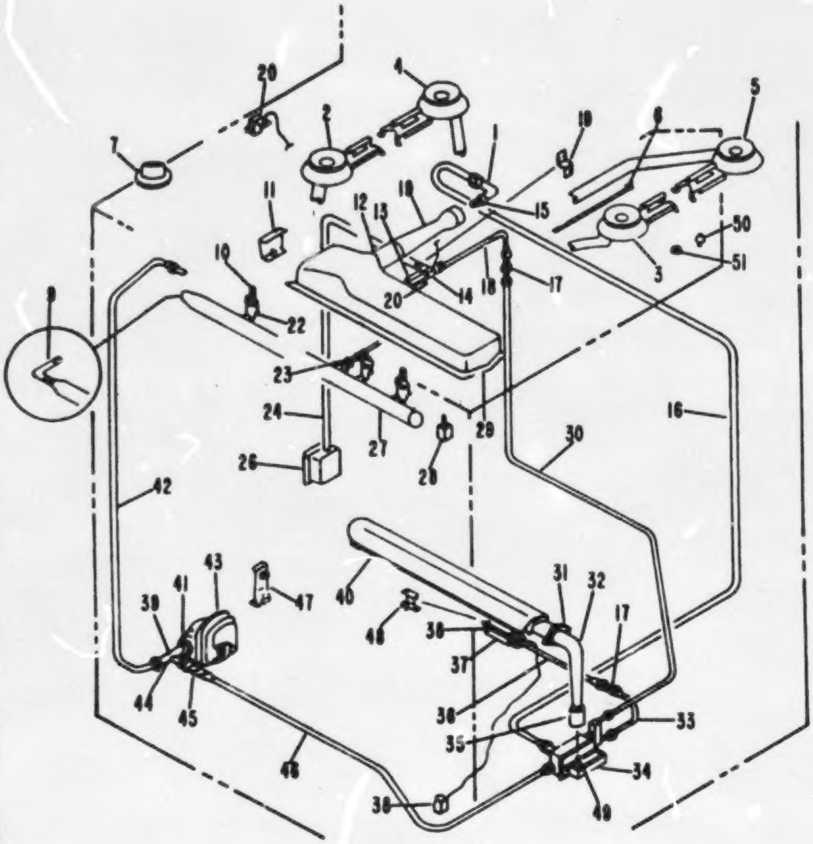

Figure 8

Gas line components

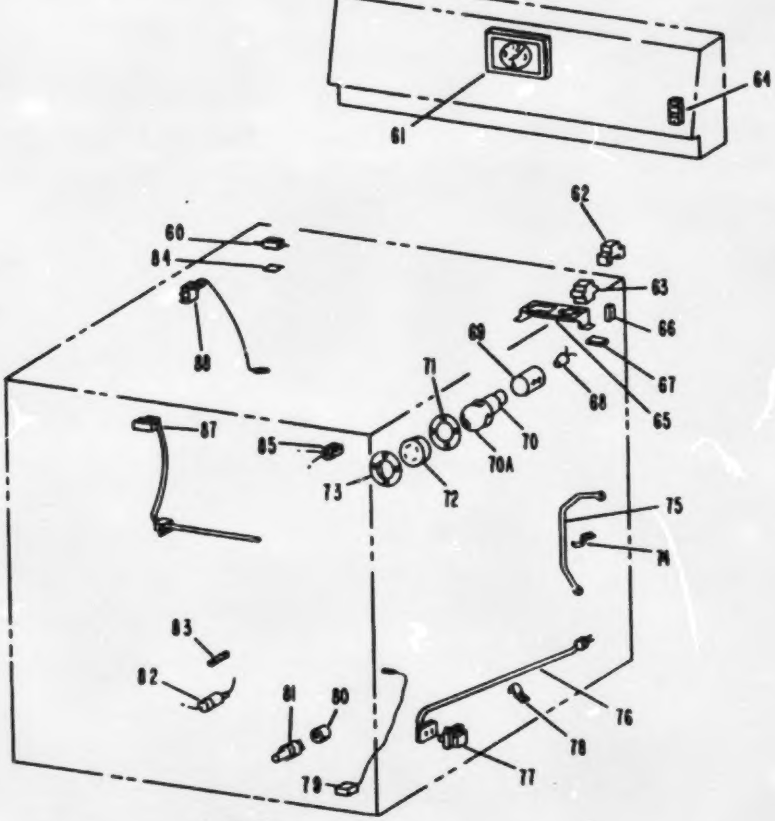

Figure 9

Electrical parts

LAP TEST ANSWER KEY: **DISASSEMBLY OF A GAS RANGE**

1. B
2. B
3. B
4. D
5. C
6. D
7. D
8. C
9. B
10. D

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: ~~Diagnosis of Malfunctions in a Gas~~ Range

OBJECTIVE:

Diagnose malfunctions in a gas range using appropriate tools and procedures.

EVALUATION PROCEDURE:

Electrical values found during diagnosis are consistent with specifications found on the manufacturer's name plate.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Diagnosis of Malfunctions - Gas Range.
Tools, test equipment, work order form and a gas range.
Service Manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Diagnosis of Malfunctions - Gas Range.

2. Complete the multiple-choice test items for this LAP.

3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): T. Ziller

76.01.06.03.A2-0

CHECKLIST: DIAGNOSIS OF MALFUNCTIONS - GAS RANGE

______ 1. Complete and attach work order form.

______ 2. Make a thorough visual inspection.

______ 3. Check line cords. (Ohmmeter). Resistance: ______

______ 4. Check timer motor. (Ohmmeter) Resistance: ______

______ 5. Check thermostat. (Pyrometer) Temperature: ______

______ 6. Check switches. (Ohmmeter) Resistance: ______

______ 7. Check condition of burner orifices and pilot orifice.

______ 8. Check mechancial seals, fittings, and connections including knobs, feet and grommets.

______ 9. Check all electrical connections.

______ 10. Check condition of insulation and bakelite.

______ 11. Plug into 115V AC (20 amp) power source.

______ 12. Check voltage source. (Voltmeter) Voltage: ______

______ 13. Comptue the power in watts dissipated by the lectric circuits in the gas range. Wattage: ______.

______ 14. Connect to gas source. (Check for gas leaks using soap).

______ 15. Light pilots and adjust to proper height.

______ 16. Ignite burners and adjust airshutter for a clean uniform flame.

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LAP TEST: DIAGNOSIS OF MALFUNCTIONS IN A GAS RANGE

1. If an automatic gas range oven burner does not shut off when set temperature is reached, what is the possible cause?

   a. a defective pilot orifice.
   b. the oven switch is faulty.
   c. the burner needs cleaning.
   d. a defective thermostat, or safety valve or excessive gas pressure.

2. If the gas range burners will not light, a possible check would be:

   a. the pilot light is too 'soft'.
   b. the flash tube alignment.
   c. the burner's air shutter is misaligned.
   d. the gas pressure is low.

3. If a gas range oven won't heat, check:

   a. door switch.
   b. electrical connections.
   c. thermostat.
   d. timer control.

4. If gas range lights will not work, check:

   a. control knob.
   b. connections to gas source.
   c. connections to power source.
   d. pilot light.

5. If gas range clock will not work, check:

   a. connections to the timer.
   b. connections to the gas source.
   c. wires and connections.
   d. the clock motor switch.

6. What is the first step for diagnosing malfunctions in a gas range?

   a. thorough visual inspection.
   b. connect to gas source.
   c. connect to electrical power.
   d. turn of master switch.

7. In a top-lighter gas range, an incomplete combustion of gas causing an odor and carbon deposits is the result of:

   a. leak around lighter valve system.
   b. pilot flame in contact with lighter.
   c. clogged valve.
   d. lighter out.

8. What method should be avoided to test for leaks when the gas range is in place and the gas supply line is connected to it?

   a. sniff test.
   b. a solution of soap and water.
   c. open flame.
   d. pyrometering.

9. An automatic lighter gas range may have a delayed ignition or complete failure; this condition may be caused by:

   a. burner's flash tubing is misaligned.
   b. pilot light is out.
   c. pilot flames that are either too low or too high.
   d. burner's spud orifice needs cleaning.

10. A procedure used when testing for gas leaks on an installed gas range is to apply a soap and water solution to all connections in the supply line. What condition exists if bubbles appear?

    a. an imminent explosion.
    b. a leak(s).
    c. proper valve seat.
    d. gas pressure.

LAP TEST ANSWER KEY: DIAGNOSIS OF MALFUNCTIONS IN A GAS RANGE

1. D
2. B
3. C
4. C
5. C
6. A
7. B
8. C
9. C
10. B

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: ~~Repair, Service and Reassembly of~~ a Gas Range

OBJECTIVES:

Order replacement parts for the gas range.

Repair, service and reassemble a gas range.

EVALUATION PROCEDURE:

The appliance must operate properly.

Correctly answer 8 out of 10 items on a multiple-choice objective test.

RESOURCES:

Checklist: Repair, Service and Reassembly - Gas Range.
Test equipment, tools, appliance parts catalogs and requisition form.
Gas Range.
Service manuals for the appliance.

PROCEDURE:

1. Follow the steps on the attached checklist: Repair, Service and Reassembly - Gas Range.

2. Complete the multiple-choice test items for this LAP.

3. Check your answers with the test key. If your answers are all correct, record your time for completing this LAP on your SPR. If you have missed any questions, try to find out why you missed the test items. If you have any further problems, check with your instructor. When you have correctly completed all the test items, you may record your time on your SPR.

Principal Author(s): T. Ziller

CHECKLIST: REPAIR, SERVICE AND REASSEMBLY - GAS RANGE

Repair and Service:

______ 1. If there is a gas leak, tighten and/or seal the connection.

______ 2. If the pilot light is low or high, adjust for about ¼" flame height.

______ 3. If the orifice is dirty, clean with solvent.

______ 4. If the tower is misaligned, adjust.

______ 5. If burner surface or oven flame is low or high, adjust orifice.

______ 6. If burner flame is orange, adjust air shutter for clear blue flame.

______ 7. If the thermocouple is not opertaing, replace with same type.

______ 8. If metering relay is open or shorted, replace with same type and size.

Reassemble:

______ 1. Replace the gas lines and tighten.

______ 2. Replace orifice.

______ 3. Mount burner heads (surface and/or oven).

______ 4. Replace tower and flash tube.

______ 5. Mount burner controls to cabinet panel.

______ 6. Replace burner control knobs.

______ 7. Connect all electrical wires to the proper terminals. (Use schematic diagram.)

______ 8. Replace all surface and oven racks.

______ 9. Replace and mount cabinet panels with proper sized screws.

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LAP TEST: REPAIR, SERVICE AND REASSEMBLY OF A GAS RANGE

1. For proper flame size on the top burner on a gas range, which of the following would be adjusted?

   a. air shutter on the manifold.
   b. control knob.
   c. pilot light.
   d. orifice hood on the valve.

2. To obtain correct flame character on the top burner on a gas range, you would adjust which of the following?

   a. pilot light.
   b. control knob.
   c. air shutter on the manifold.
   d. orifice hood on the valve.

3. On a typical push-button-type gas range lighter, if it leaks around the push button, what procedure should be followed?

   a. use silicone packing.
   b. replace graphite packing.
   c. replace rubber washer.
   d. use a water pump pliers.

4. When replacing gas valves in a gas range, it's necessary to replace what part(s)?

   a. spring.
   b. orifice only.
   c. valve only.
   d. orifice and valve.

5. Pilot outage and odor are sometimes experienced with gas range lighters that have a solid top lighter hood and can be adjusted by which of the following methods?

   a. tap the threads with a 1/2" tap to seat gas valve.
   b. turn a set screw counter clockwise on the air shutter.
   c. use 1/2" wrench to turn the orifice lock nut.
   d. drill 1/2" diameter hole in top of hood.

6. If a gas range heater pilot flame does not burn properly due to a high gas pressure, correction is made by:

   a. installing a thermocoupler.
   b. installing a bypass flame.
   c. installing dual gas main controls.
   d. installing a pressure regulator.

7. If the gas passages in the gas range orifice are clogged, what procedure should be followed?

   a. remove the valve and clean it.
   b. replace valve only.
   c. replace orifice only.
   d. replace spring.

8. If a gas range oven control temperature sensing bulb causes oven temperatures to exceed 600°F or more, with control dial at 350°F, follow what procedure for correcting?

   a. replace control switch.
   b. replace thermostat.
   c. replace the bypass valve.
   d. replace sensing bulb.

9. If a gas range top lighter pilot goes out and the tip is clean what procedure should be followed?

   a. turn the gas main's pressure up.
   b. relight the pilot.
   c. the push button assembly will have to be removed to clean the gas passages.
   d. completely install a whole new pilot light assembly.

10. When the adjustable distance allowed for wear on the gas range valve plug is completely used and the bottom plug rests on the shoulder of the body, correct by:

    a. replacing gas valves and orifice.
    b. shimming up with polyvinyl washers.
    c. boring out the valve seat.
    d. cleaning out and reinstall.

LAP TEST ANSWER KEY: REPAIR, SERVICE AND REASSEMBLY OF A GAS RANGE

1. D
2. C
3. B
4. D
5. D
6. D
7. A
8. D
9. C
10. A

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Date: ____________________ Date Published: 11/18/74

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UNIT POST TEST: GAS RANGES

76.01.06.01

1. The minimum distance between the gas range burner and the surface that is to be heated is:

   a. fixed by the proper combustion of the flames.
   b. fixed by the serviceman.
   c. fixed by the flow of gas.
   d. fixed by the thermostat.

2. The clock control used with automatic oven ignition systems functions to:

   a. regulate the gas mixture.
   b. regulate the temperature.
   c. directly control the operation of a shutoff valve.
   d. light the oven.

3. The snap-action type thermostat on a gas range is one in which the thermostatic valve:

   a. travels instantly from the closed to the open position, or vice versa.
   b. travels through the gas main to the valve.
   c. ignites the gas burner.
   d. extinguishes the pilot in case of malfunction.

4. The function of the bypass on a gas range:

   a. permits unburnt gas to escape through the flue.
   b. controls the main gas valve.
   c. it permits a flow of gas from the inlet to the outlet connection.
   d. bypasses the gas to another appliance.

5. The advantage of the ring burner on a gas range is:

   a. that the gas flows freely into the ring type burner.
   b. that it is easier to clean the burner.
   c. that the flame hits the cooking pans better.
   d. that it provides a better supply of secondary air to all parts of the flame.

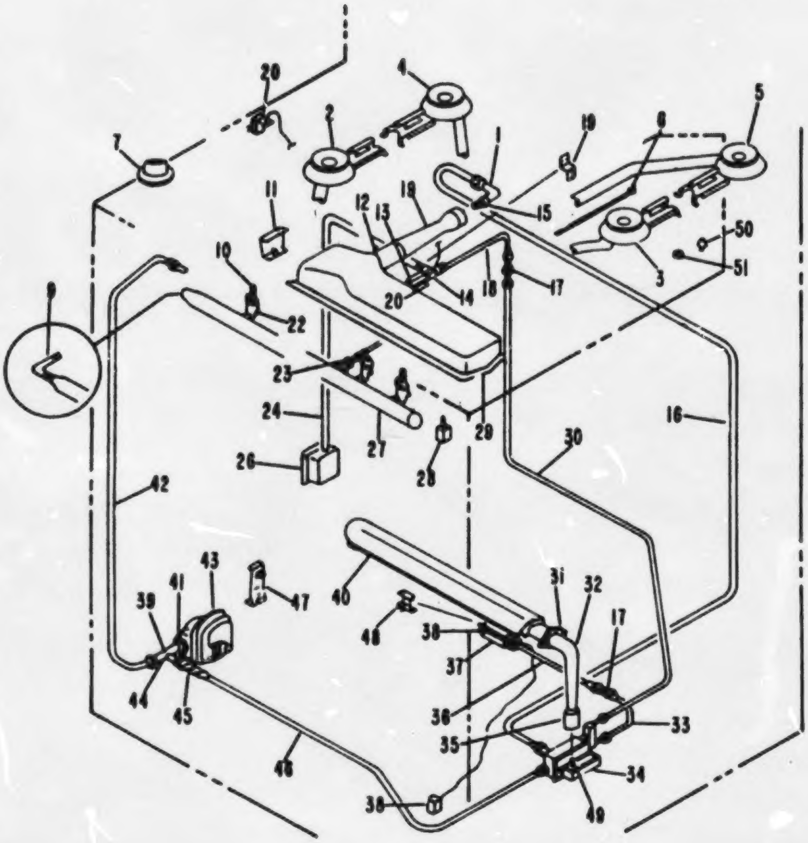

Figure 8

Gas line components

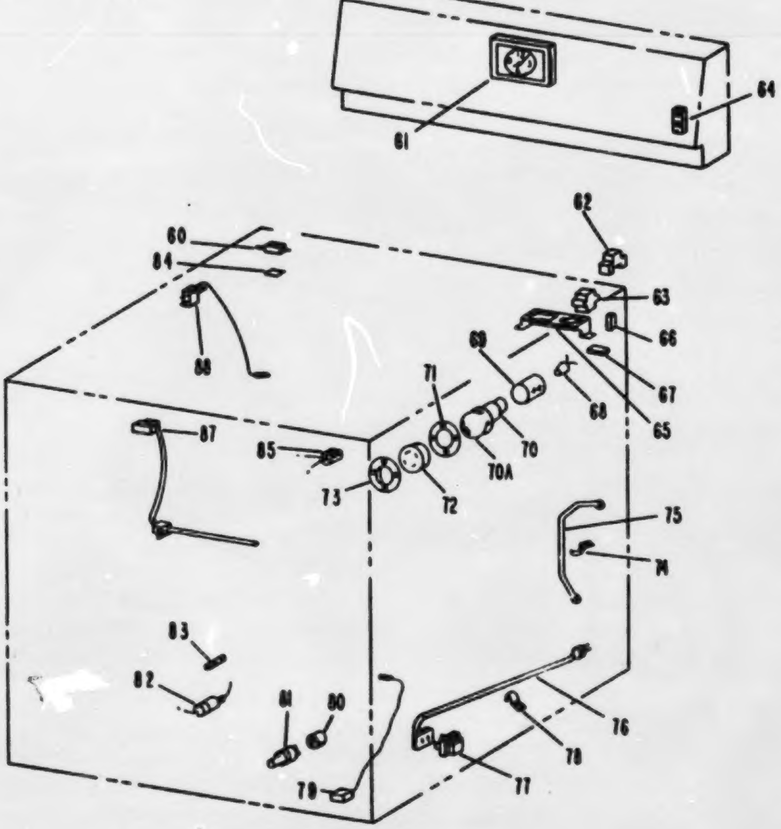

Figure 9

Electrical parts

76.01.06.02

6. Identify by number (Fig. 8) the tubing top pilot-LH on a gas range.

   a. 15
   b. 19
   c. 6
   d. 17

7. Identify by number (Fig. 8) the tubing w/fillings-3/16" O.D.-union to oven pilot on a gas range.

   a. 36
   b. 40
   c. 48
   d. 38

8. Identify by number (Fig. 8) the oven burner lower on a gas range.

   a. 19
   b. 38
   c. 27
   d. 40

9. Identify by number (Fig. 9) the oven light switch on a gas range.

   a. 64
   b. 85
   c. 87
   d. 80

10. Identify by number (Fig. 9) the oven lamp on a gas range.

   a. 63
   b. 71
   c. 72
   d. 70A

76.01.06.03

11. If an automatic gas range oven will not come up to set temperature, check the:

   a. oven thermostat calibration.
   b. gas source.
   c. electrical source.
   d. pilot adjustment.

76.01.06.03 (continued)

12. If there is a soft flame on the tower pilot on a thermal eye burner on a gas range, check to see if:

    a. the orifice and tower are not aligned.
    b. the gas pressure is too low.
    c. the gas pressure is too high.
    d. the orifice and tower are aligned.

13. If the gas range burner flame is too small or too high (top or oven), a possible check would be:

    a. simmer adjustments.
    b. orifice adjustments screw.
    c. flash tube alignment.
    d. pilot light height adjustment.

14. If pilots on a gas range keep going out, a possible check would be:

    a. orifice hood.
    b. burner spuds.
    c. gas pressure.
    d. valve stem.

15. Top-lighter pilots on a gas range are sensitive to pressure variation or internal stoppage, which may be the cause of:

    a. barometric pressure variations.
    b. gas shortage.
    c. outage problems.
    d. dirty gas supply.

76.01.06.04

16. Before adjusting the bypass flame on a gas range, it is first necessary to light the oven burner when the thermostat and valve are in what position?

    a. thermostat in hot position and valve completely open.
    b. thermostat in cold position and valve completely closed.
    c. thermostat in hot position and valve completely closed.
    d. thermostat in cold position and valve completely open.

17. Before starting the gas range installation, turn off all other gas appliances; the next procedure would be to:

    a. turn off all controls on the gas range.
    b. check for gas leaks in and around the gas main.
    c. disconnect electrical power source.
    d. shut off gas supply at the main inlet.

76.01.06.04 (continued)

18. To prevent leakage around threaded joints on a gas range pipe which of the following would be recommended?

    a. grease lubricant.
    b. liquid soap.
    c. joint compound and gas line gaskets.
    d. liquid solder.

19. If a leak exists around the lighter valve stem on a top lighter gas range, what procedure must be followed?

    a. remove the nut and replace the graphite packing.
    b. change the valve assembly.
    c. replace spud.
    d. replace flue control.

20. The principal servicing of gas range burner valves involves:

    a. relighting pilot lights.
    b. replacing new burner assembles.
    c. regreasing or tightening loose nuts.
    d. replacing new valve stems.

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Date: ______________________ **Date Published:** 11-19-74

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

UNIT POST TEST: MIXERS AND BLENDERS

76.02.01.01.

1. In mixers equipped with bowl turntables, or revolving discs, the position of the beaters is adjusted by means of a:

   a. control-plate assembly.
   b. governor control.
   c. lever arrangement.
   d. turntable slip-clutch.

2. The beater gears and spindles of an electric food mixer are driven by:

   a. syncro mesh gears.
   b. a slip clutch assembly.
   c. a worm gear on the armature shaft.
   d. rack and pinion gears.

3. The ejection of the beaters of a food mixer is accomplished through the hollow spindle shafts by:

   a. a spring returned push-out plate.
   b. a hook on the spindle.
   c. a notch on the handle.
   d. reversing the motor.

4. The beaters of an electric mixer are held into place by springs in the spindles that:

   a. suppress the beater handle.
   b. coil around the beaters.
   c. intermesh with the beater shaft.
   d. interlock with the ears on the motor shaft.

5. The beater speed on a food mixer is directly related to:

   a. turns ratio formula.
   b. the gear selection.
   c. the armature speed.
   d. control knob setting.

76.02.01.02.

6. Locate by number the field coil (upper) in (Fig. 1) of an electric food mixer.

a. XM18X22
b. XM11X23
c. XM25X565
d. XM25X374

7. Locate by number the bearing, front assembly in Fig. 1 of the electric food mixer.

a. XM25X454
b. XM25X360
c. XM1X100
d. XM1X25

8. Locate by number the brush holder assembly L.H. in Fig. 1 of the electric food mixer.

a. XM11X23
b. XM1X122
c. XM2X1
d. XM2X8

9. In the disassembly view in Fig. 1 of the electric food mixer the number XM25X360 is the location of the:

a. bearing, front assembly.
b. thrust bearing.
c. cap, bearing.
d. ejector knob.

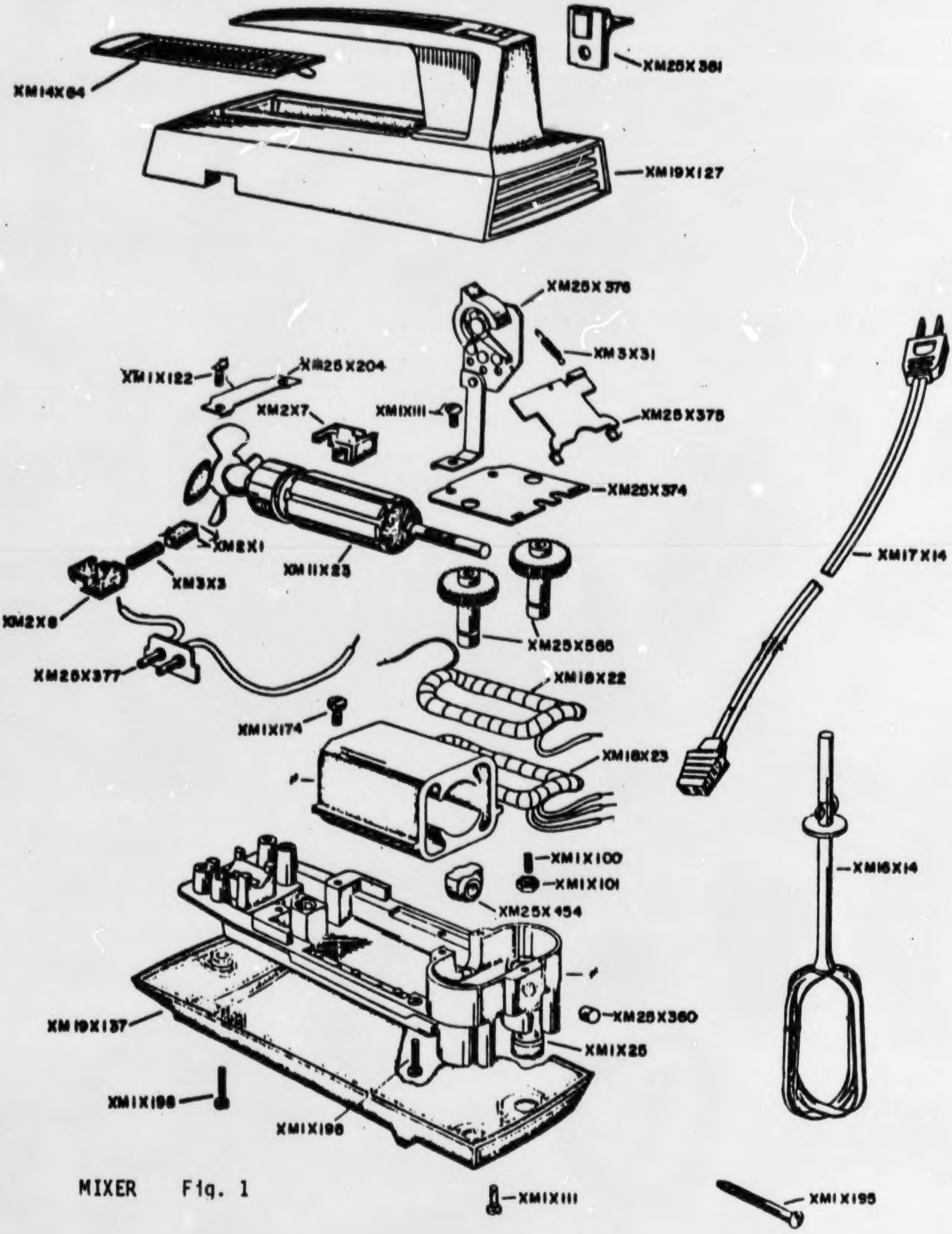
10. Locate by number the ejector knob in Fig. 1 of the electric food mixer.

a. XM25X454
b. XM25X360
c. XM25X381
d. XM3X31

76.02.01.03.

11. If a food mixer overheats, check:

a. for shorted turns in either the field coil or the armature.
b. loose bearings.
c. a shorted brush circuit.
d. a shorted switch in the control assembly.


XM25X381
XM14X64
XM19X127
XM25X376
XM3X31
XM1X122
XM25X204
XM2X7
XM1X111
XM25X375
XM25X374
XM2X1
XM11X25
XM3X3
XM2X8
XM17X14
XM25X565
XM25X377
XM18X22
XM1X174
XM18X23
XM1X100
XM1X101
XM25X454
XM16X14
XM19X137
XM25X360
XM1X25
XM1X198
XM1X196
XM1X111
XM1X195

MIXER Fig. 1

76.02.01.03. (continued)

12. If food mixer is noisy during operation, check:

    a. end play of armature.
    b. rough varnish on the windings.
    c. cracked brushes.
    d. too much lubrication.

13. If a noisy food mixer is caused by a bad segment of the armature, check:

    a. bar to bar voltage across the armature.
    b. bar to bar resistance across the commutator.
    c. commutator stability.
    d. armature's commutator polarity.

14. If there is insufficient speed on the food mixer, check:

    a. for a bind in the bearing or spindles.
    b. wire connections for parallel hook-up.
    c. series shunt resistor.
    d. current limitor device.

15. If a food mixer has a surging motor, check:

    a. the surge resistor.
    b. the actuator for restraint in movement.
    c. the motor master control.
    d. the centrifugal switch.

76.02.01.04.

16. If there is end play of the armature on a food mixer, correct by:

    a. packing with grease.
    b. tightening the brushes.
    c. shortening the worn gear.
    d. adjusting the slotted thrust screw.

17. When replacing the food mixer fan, be sure:

    a. to tighten the set screw.
    b. fan is pressed onto the armature shaft and clear the case and is not near gear faces.
    c. to file the edges so it will clear.
    d. to bend the blades to attract more air.

76.02.01.04. (continued)

18. If the resistance in a food mixer coil is noticably low, what procedure should be followed?

    a. armature should be replaced.
    b. replace defective coil.
    c. solder coil to armature.
    d. clean coil.

19. When lubricating food mixer gears and spindles, apply lubricant in what manner?

    a. fill the oil reservoir.
    b. fill the extra space with grease.
    c. wipe the gears clean and apply two drops of oil.
    d. just enough to coat all gear teeth and surfaces.

20. What procedure should be followed when reinstalling spindles on a food mixer?

    a. slots should be 36° relative to each other to avoid beater clash.
    b. slots should be 90° relative to each other to avoid beater clash.
    c. slots should be 45° relative to each other to avoid beater clash.
    d. slots should be 180° relative to each other to avoid beater clash.

76.02.01.05.

21. At any selected pushbutton setting, the blender speed may be obtained by:

    a. live voltage changes.
    b. capacitor setting.
    c. resistor setting.
    d. diode and/or taps in the field coil.

22. The blender operates on what type(s) of current?

    a. pulsating D.C.
    b. D.C.
    c. A.C./D.C.
    d. A.C.

23. Why is it necessary to use the commutator and brush gear for feeding electricity to the rotating coils on a blender?

    a. sliding contact makes it possible to pass electricity in the spinning armature without using solid contacts.
    b. solid contacts make it possible to pass electricity to the armature.
    c. wire contacts make it possible to pass electricity to the commutator.
    d. no contacts are used. A resistor circuit is used to pass electricity to the commutator.

76.02.01.05. (continued)

24. What prevents the blender armature shaft from overheating or wearing down?

    a. bearing(s).
    b. brush gear.
    c. windings.
    d. commutator.

25. The blender armature assembly turns in a :

    a. magnetic field.
    b. static field.
    c. open field.
    d. constant field.

76.02.01.06.

26. Identify by number (Fig. 2) the Bushing, Jar Fitting Assembly on a blender.

    a, XM25X805
    b. XM25X436
    c. XM28X79
    d. XM1X188

27. Identify by number (Fig. 2) the Armature Plate on a blender.

    a. XM11X57
    b. XM25X264
    c. XM25X729
    d. XM25X427

28. Identify by number (Fig. 2) the (Upper) Coil Assembly on a blender.

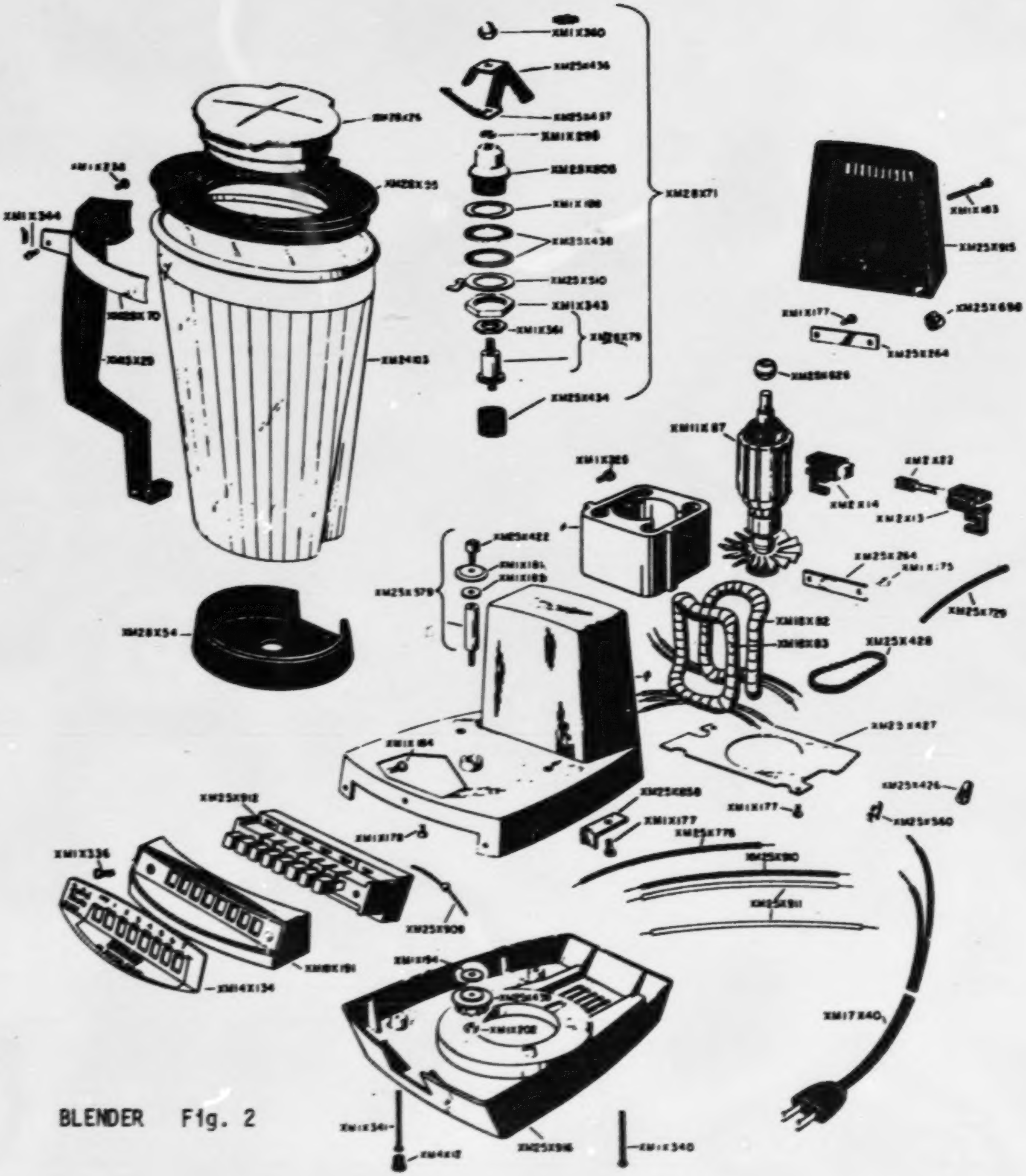
    a. XM1X325
    b. XM18X83
    c. XM18X82
    d. XM11X57

29. Identify by number (Fig. 2) the Bearing Strap on a blender.

    a. XM2X22
    b. XM25X729
    c. XM25X264
    d. XM2X13

30. Identify by number (Fig. 2) the Drive Belt on a blender.

    a. XM11X57
    b. XM25X729
    c. XM25X428
    d. XM18X82



BLENDER Fig. 2

76.02.01.07.

31. Check which of the following part(s) if the motor runs but blades will not turn on a blender?

    a. diode.
    b. armature shaft.
    c. neoprene seal and nut.
    d. universal coupling or driver shaft.

32. If blade edges are chipped or rolled over on a blender, what procedure should be followed?

    a. bend blades in shape.
    b. replace blades.
    c. apply heat to blades.
    d. solder blades.

33. Check for loose fit between the spindle and bearing on a blender, if what condition exists?

    a. blender jar leaks.
    b. motor runs but blades won't turn.
    c. blender is noisy during operation.
    d. blender jar is noisy during operation.

34. If the blender is noisy after checking the driver shaft and driver bearing, check:

    a. armature bearings.
    b. commutator.
    c. carbon brushes.
    d. for loose blades.

35. Too tight a belt on the blender will cause what condition?

    a. noisy blender.
    b. high watts and low speeds.
    c. motor runs but blades won't turn.
    d. blender runs only at one speed.

76.02.01.08.

36. What is the procedure for repairing the control on the blender?

    a. disassembly, repair, and replace the control.
    b. file the points in the control.
    c. no attempt should be made.
    d. replace the stator on the control.

76.02.01.08. (continued)

37. To decrease speed on the blender, what procedure should be followed?

    a. turn the potentiometer clockwise.
    b. turn trimmer clockwise.
    c. turn trimmer counterclockwise.
    d. turn the potentiometer counterclockwise.

38. If there is a loose fit between the spindle and bearing, correct by:

    a. building up the spindle with solder.
    b. replacing the bearing.
    c. replacing both parts.
    d. tightening the bearing.

39. Before installing the base and back covers of a blender, check:

    a. the thermal cut out (reset).
    b. motor oil.
    c. control knob (attach).
    d. leads.

40. To replace the escutcheon, be certain it is:

    a. leak proof.
    b. correctly positioned the first time.
    c. correctly tempered.
    d. moveable.

UNIT TEST ANSWER SHEET
POST TEST

Occupational Area: ______
File Code: 76.01.06.00.B2-2
Name: ______

ANSWERS

76.01.06.01 1. A ______
2. C ______
3. A ______
4. C ______
5. D ______
6.01.06.02 6. C ______
7. A ______
8. D ______
9. A ______
10. D ______
76.01.06.03 11. A ______
12. A ______
13. A ______
14. C ______
15. C ______
76.01.06.04 16. C ______
17. D ______
18. C ______
19. A ______
20. C ______

21. ______
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56. ______
57. ______
58. ______
59. ______
60. ______

Student: ____________________ File Code: 76.01.06.00.A1-5

Date: ____________________ Date Published: 11/13/74

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Family Pay Number: __________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: GAS RANGES

OBJECTIVE 1:

Given a malfunctioning gas range, the student will service and repair the gas range so that it functions according to the manufacturer's specifications, following safe practices and procedures.

OBJECTIVE 2:

Using appropriate tools and test equipment, the student will calculate and record amperage, voltage, resistance, and wattage of a gas range's electrical system.

OBJECTIVE 3:

Given a gas range the student will connect to a gas source using appropriate tools.

OBJECTIVE 4:

The student will light and adjust pilot lights. (surface and oven)

OBJECTIVE 5:

Using appropriate tools the student will adjust burner's air shutter for proper gas/air mixture.

TASK:

The student will service and repair a malfunctioning gas range and, in the process, he will take and record amperage, voltage, resistance and wattage readings of the electrical circuits using appropriate test equipment.

ASSIGNMENT:

CONDITIONS:

The student will be given a malfunctioning gas range (it may be bugged by the instructor or it may be one brought in by a customer). He will be required to service and repair the gas range in conditions similar to those in a typical appliance repair shop. He will be allowed to use any and all tools, equipment, service manuals, text books, etc., commonly found in a repair shop. He must complete it in a reasonable length of time with no assistance from the instructor(s) or students.

RESOURCES:

Tools:

Amprobe RS-3 Rotary Meter (B-A)
Soldering gun 100 to 140 watt
Adjustable Wrench
Nut Driver Set
Long Nose Pliers
Diagonal Cutters
Slip Joint Pliers
Screwdriver Set
Phillips Set
Hex & Spline Wrench Kit
Vise Grip Plier Model Size 7"
Utica Electrician's Knife, Standard Size
18" Aluminum Level
12' Steel Tape
Punch & Chisel Set, 1/2", 5/8" chisels; 3/16, 3/8, 5/32 punches
Combination Wrench Set
Hammer (Ball Peen) 12 oz.
10" Channel-lock Plier
Utility Box
VOM
Assortment of wire, fasteners and repair parts
Gas Range

Printed Material:

Various Repair Manuals
Manufacturer's Specification Sheets

Student: ____________________

File Code: 76.01.06.00.A1-5

Date: ____________________

Date Published: 11/13/74

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Glasgow AFB, Montana 59231

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Follows safe practices and procedures.		
Criterion: No injury results to the student or the equipment and		
complies with OSHA requirements.		
2. Follows proper procedures for disassembly.		
Criterion: No damage results to the appliance.		
3. Diagnosis and troubleshoots malfunctions properly.		
Criterion: When repaired, the appliance functions according to the		
manufacturer's specifications.		
4. Reassembles the appliance properly.		
Criterion: Appliance functions according to the manufacturer's specifications		
and the procedures followed agree with those described in the		
service literature.		
5. The repaired appliance is repaired in a neat,		
professional manner.		

	CRITERION	
	Met	Not Met
Criterion: No damage results to the appliance such as scratches and dents.		
6. All connections and fastening are properly completed.		
Criterion: The appliance connection complies with the manufacturer's specifications. The connection is mechanically fastened and structurally sound. The connection is electrically fastened and free of defects.		
7. Appliance functions according to the manufacturer's specifications.		
Criterion: Manufacturer's specifications.		
8. Uses appropriate repair part and supplies.		
Criterion: They match exactly those listed in the manufacturer's specifications.		
Objective 2:		
9. Uses test equipment properly.		
Criterion: Manufacturer's specifications.		
10. Wattage readings are accurate.		
Criterion: Manufacturer's specifications.		
11. Voltage readings are accurate.		
Criterion: Manufacturer's specifications.		
12. Amperage readings are accurate.		

	CRITERION	
	Met	Not Met
Criterion: Manufacturer's specifications.		
13. Resistance readings are accurate.		
Criterion: Manufacturer's specifications.		
14. When applicable mathematical calculations are correct.		
Criterion: AC/DC Circuit Manuals, Westinghouse.		
Objective 3:		
15. Student uses proper size wrench.		
Criterion: Fits the fittings size snuggly.		
16. Student uses soap to check for leaks.		
Criterion: Avoids an explosion when match is struck or cigarette is in the area.		
Objective 4:		
17. Student lights the pilots using a match or lighter.		
18. Student adjusts the pilot adjustment screw for proper height (3/16").		
Criterion: **Pilot burns without going out.**		
Objective 5:		
19. The student adjusts air shutter to form a flame character of a solid blue flame.		
20. The student adjusts flame height at maximum control.		

(Checklist continued)

	CRITERION Met	 Not Met
Criterion: The flame burns clean and free of soot.		
21. The appliance is repaired in a reasonable time.		
Criterion: Not to exceed 2 hours.		
The student must pass 18 out of 21 line items to achieve an		
overall score of satisfactory.		